NASA ER-2 Madison, Wisconsin Deployment

WINter EXperiment
WINTEX

FY-1999
Mission Summaries*

15 March to 4 April 1999

WINter EXperiment (WINTEX)

99-050	15 March	Ferry - Dryden to Madison, Wisconsin
99-051	18 March	Wisconsin
99-052	19 March	Aborted flight
99-053	20-21 March	Canada
99-054	21-22 March	Lake Michigan and Wisconsin
99-055	25-26 March	Lake Superior
99-056	26-27 March	Canada and Wisconsin
99-057	29-30 March	Lake Michigan
99-058	31 March	Wisconsin and Lake Michigan
99-059	1 April	Oklahoma CART site
98-060	4 April	Ferry – Madison, Wisconsin to Dryden

WINTEX Overview

A WINter EXperiment (WINTEX) was being conducted from Madison, Wisconsin from March 15 to April 2 to define the measurement requirements for the next generation of the National Polar Orbiter Environmental Satellite System and to further global climate studies. NASA's high altitude Environmental Research aircraft (the ER-2) flies 19 km above the earth to simulate satellite observations. The ER-2 carries highly advanced sensors of surface, cloud, and atmospheric temperature and moisture profile conditions using two different types of instruments—imagers and sounders.

The imagers provide visible and infrared pictures of clouds, the atmosphere, and Earth's surface, with a surface resolution of 50 meters. The sounders provide temperature and moisture profile observations similar to what is traditionally obtained by an ascending weather balloon. From the ER-2, however, these profiles will be obtained with exceptionally high spatial resolution, every 2.5 km within a 46 km wide swath along the flight track of the ER-2 aircraft.

WINTEX has two major objectives:

To validate atmospheric soundings observed across polar frontal systems—the ER-2 will fly from southern Wisconsin northward across Canada deep into the cold Arctic air mass behind the cold front. These flights will be centered around 6 a.m. and 6 p.m. local Madison time to take advantage, for validation purposes, of observations from weather balloons released at these times by the National Weather Service. To test the ability of the imaging and sounding sensors to sense the geometrical and optical properties of clouds which are particularly difficult to detect over snow and ice surfaces—the flights will be more localized around specific cloud systems.

The University of Wisconsin–Madison has also established a ground-based system of lasers, interferometers, and weather balloons to validate the ER-2 sounding and cloud observations over Madison.

The ER-2 sounding sensors were developed jointly by the Massachusetts Institute of Technology's Lincoln Laboratories, the University of Wisconsin–Madison, and NASA under the sponsorship of the Integrated Program Office, an Air Force, NOAA, and NASA group developing this nation's next generation polar orbiting weather satellite system. The ER-2 sounding measurements, of much higher resolution and higher accuracy than is currently achievable from today's weather satellites, will be used to refine the measurement characteristics for next generation systems. Improvements in local, regional, and global weather forecasts will result from the operational implementation of these sensors. The ER-2 measurements obtained during WINTEX are also being used to validate algorithms being developed to process imaging and sounding data from NASA's Earth Observing System (EOS)
satellites, the first of which is scheduled to be launched in July 1999.

The above summary was extracted from the WINTEX web page at:
http://cimss.wisc.edu/wintex/overview.html

Airborne Science Program

The Airborne Science Program at NASA's Dryden Flight Research Center, Edwards, California, operates two ER-2 high altitude aircraft in support of NASA earth science research. The ER-2s are used as readily deployable high altitude sensor platforms to collect remote sensing and in situ data on earth resources, celestial phenomena, atmospheric dynamics, and oceanic processes. Additionally, these aircraft are used for electronic sensor research and development and satellite investigative support.

The ER-2s are flown from various deployment sites in support of scientific research sponsored by NASA and other federal, state, university, and industry investigators. Data are collected from deployment sites in Kansas, Texas, Virginia, Florida, and Alaska. Cooperative international scientific projects have deployed the aircraft to sites in Great Britain, Australia, Chile, and Norway.

Photographic and digital imaging sensors are flown aboard the ER-2s in support of research objectives defined by the sponsoring investigators. High resolution mapping cameras and digital multispectral imaging sensors are utilized in a variety of configurations in the ER-2s' four pressurized experiment compartments. The following provides a description of the digital multispectral sensor(s) and camera(s) used for data collection during this flight.

MODIS Airborne Simulator

The MODIS Airborne Simulator (MAS) is a modified Daedalus multispectral scanner configured to replicate the capabilities of the Moderate-Resolution Imaging Spectrometer (MODIS), an instrument to be orbited on an EOS platform. MODIS is designed for the measurement of biological and physical processes and atmospheric temperature sounding. The MODIS Airborne Simulator records fifty 16-bit channels of multispectral data and is configured as follows:

Spectral Channel	Band center (µm)	Bandwidth (µm)	Spectral Range
1	0.4649	0.0397	0.4451-0.4848
2	0.5494	0.0417	0.5285-0.5703
3	0.6550	0.0511	0.6294-0.6805
4	0.7024	0.0415	0.6816-0.7231
5	0.7431	0.0420	0.7221-0.7641
6	0.8248	0.0427	0.8034-0.8461
7	0.8667	0.0414	0.8460-0.8874
8	0.9072	0.0409	0.8867-0.9276
9	0.9476	0.0397	0.9277-0.9674
10	1.6422	0.0519	1.6163-1.6682
11	1.6975	0.0505	1.6722-1.7228
12	1.7499	0.0506	1.7245-1.7752
13	1.8014	0.0491	1.7768-1.8259

Spectral Channel	Band center (µm)	Bandwidth (µm)	Spectral Range
26	3.1192	0.1616	3.0384-3.2000
27	3.2809	0.1486	3.2066-3.3552
28	3.4330	0.1617	3.3521-3.5138
29	3.5940	0.1539	3.5170-3.6709
30	3.7449	0.1449	3.6724-3.8174
31	3.9069	0.1602	3.8267-3.9870
32	4.0707	0.1554	3.9929-4.1484
33	4.1699	0.0669	4.1365-4.2034
34	4.4029	0.1255	4.3401-4.4656
35	4.5404	0.1512	4.4648-4.6160
36	4.6979	0.1591	4.6184-4.7775
37	4.8536	0.1516	4.7778-4.9294
38	5.0033	0.1468	4.9298-5.0767

14	1.8548	0.0489	1.8303-1.8792
15	1.9044	0.0487	1.8801-1.9288
16	1.9553	0.0483	1.9312-1.9794
17	2.0048	0.0487	1.9804-2.0291
18	2.0551	0.0484	2.0309-2.0793
19	2.1037	0.0486	2.0794-2.1280
20	2.1532	0.0483	2.1291-2.1774
21	2.2019	0.0481	2.1779-2.2259
22	2.2522	0.0486	2.2278-2.2675
23	2.3021	0.0487	2.2777-2.3265
24	2.3512	0.0476	2.3274-2.3750
25	2.4005	0.0483	2.3764-2.4246

39	5.1588	0.1400	5.0888-5.2288
40	5.3075	0.1327	5.2412-5.3738
41	5.3977	0.0755	5.3590-5.4365
42	8.5366	0.3950	8.3391-8.7341
43	9.7224	0.5365	9.4541-9.9906
44	10.5071	0.4579	10.278-10.736
45	11.0119	0.4710	10.776-11.247
46	11.9863	0.4196	11.776-12.196
47	12.9013	0.3763	12.713-13.089
48	13.2702	0.4584	13.041-13.500
49	13.8075	0.5347	13.540-14.075
50	14.2395	0.3775	14.051-14.428

NOTE: Bandpass centers approximate

Sensor/Aircraft Parameters:

Spectral Bands:	50 (digitized to 16-bit resolution)
IFOV:	2.5 mrad
Ground Resolution:	163 feet (50 meter at 65,000 feet)
Swath Width:	22.9 mi/19.9 nmi (36 km)
Total Scan Angle:	85.92^{o}
Pixels/Scan Line:	716
Scan Rate:	6.25 scans/second
Ground Speed:	400 kts (206 m/second)
Roll Correction:	Plus or minus 3.5 degrees (approx.)

Camera Systems

Various camera systems and films are used for photographic data collection. Film types include high definition color infrared, natural color, and black and white emulsions. Available photographic systems are as follows:

- Wild-Heerbrugg RC-10 metric mapping camera
  - 9 x 9 inch film format
  - 6 inch focal length lens provides area coverage of 16 x 16 nautical miles from 65,000 feet
  - 12 inch focal length lens provides area coverage of 8 x 8 nautical miles from 65,000 feet

- Hycon HR-732 large scale mapping camera
  - 9 x 18 inch film format
  - 24 inch focal length lens provides area coverage of 4 x 8 nautical miles from 65,000 feet

- IRIS II Panoramic camera

- 4.5 x 34.7 inch film format
- 24 inch focal length lens
- 90 degree field of view provides area coverage of 2 x 21.4 nautical miles from 65,000 feet

Video Imaging System

The Video Imaging System (VIS) is designed as a visual Line-of -Flight tracker, producing a flight record on standard or Super-VHS, with a selection of ground coverage and image recording intervals. The system consists of a Hitachi KP-C551 Color Camera, A Panasonic AG-6750A Time Lapse Video Recorder, DC/AC Inverter, Control Box, Pressure Suitcase, and a Installation Rack. The system may be configured to acquire natural color or black and white imagery. IRIG-B navigation data is also recorded in flight. The VIS is designed to be installed in either the Pod or Nose of the ER-2 aircraft, using a modified RC-10 Rack. Control circuitry is designed to operate the system using the same controls as the RC-10 camera.

NPOESS Aircraft Sounder Testbed - (NAST-I)

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) Atmospheric Sounding Testbed (NAST) is a suite of airborne infrared and microwave spectrometers, being developed for the Integrated Program Office (IPO), that are being flown on the NASA high altitude ER-2 aircraft as part of the risk reduction effort for NPOESS. In addition to their stand-alone scientific value, data from these airborne instruments will be used to simulate possible satellite-based radiance measurements, therefore enabling experimental validation of instrument system specifications and data processing techniques for future advanced atmospheric remote sensors (e.g., the proposed sounder component for NPOESS).

The NAST-I is a high resolution Michelson interferometer, developed by MIT Lincoln Laboratory, that derives its heritage from the non-scanning High resolution Interferometer Sounder (HIS) developed by researchers at the University of Wisconsin and serves as a critical component of the NAST instrument suite. It will scan the Earth beneath the ER-2 with a nominal spatial resolution of approximately 2.5 km with 13 Earth view observations in the cross-track direction (resulting in a cross-track swath width of about 45 km), with an unapodized spectral resolution of 0.25 cm-1 within the 3.6 - 17 micron (590 - 2810 cm-1) spectral range. The NAST-I instrument flies in the superpod of NASA's high altitude ER-2 aircraft. Its infrared radiance observations will provide information on the spectral characteristics of the atmosphere and surface, enabling detailed retrievals of atmospheric temperature and water vapor profiles at high temporal and spatial resolution. Specific science products will consist of direct and derived quantities associated with the measured infrared radiance spectra. Direct products will include brightness temperatures for discrete wavelength intervals sensitive to variations in the desired geophysical parameters, i.e., surface temperature, and atmospheric temperature and water vapor. Derived products will include surface temperature, atmospheric temperature and water vapor content representative of

different atmospheric vertical layers, cloud top pressure and thermodynamic state, as well as tropospheric trace gas concentrations.

NAST-I measurements obtained during the CAMEX-3 field experiment will be available from the project's data archive; most products will be in both an image format (i.e., GIF) for quick-look browsing and a digital format (i.e. NetCDF) suitable for further data analysis

NAST-I Point of Contact:
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The NAST-I Homepage: http://cimss.ssec.wisc.edu/nast

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Microwave Temperature Sounder or NAST-M

The new M.I.T. Microwave Temperature Sounder (MTS), which is designated NAST-M when flown as the microwave component of the NPOESS Aircraft Sounding Testbed, is a complete upgrade of the MTS instrument which has been flown by M.I.T. on NASA ER- 2 aircraft since 1988. (ref Gasiewski). This package consists of two radiometers: the first with eight single-sideband channels between 50 and 57 GHz and the second with nine double-sideband channels within 4 Ghz of the 118.75 oxygen line. Both radiometers have scalar feedhorns with 7.5 ° 3-dB beamwidths and ashared mirror scans pattern of 18 spots from -65 ° to +65 ° from nadir, two black-body calibrationloads and a chimney-view of zenith during a nominal 6.5-second scan. This scan pattern provides abutting beams across track and beams also overlap along track at distances greater than 10 km from the aircraft at the ER-2's flight velocity of 210 m/s. Scan speeds can be adjusted to achieve other overlaps in beam coverage, but the nominal pattern has an integration time on the order of 100 ms per spot and yields data at a rate of less than 2 kB per second or 7.2 MB per hour.

A video camera mounted in the package will provide digitized stereoscopic images (using scan lines forward and aft) from which cloud-top altitudes may be estimated. A GPS receiver has also been included in the package as a backup to other navigational data streams.

Atmospheric opacity in the MTS passbands is primarily due to diatomic oxygen, and thermal emission from this well-mixed species is the primary source of signal in MTS views of clear air. Temperature weighting functions for nadirial view from 20 km though a U.S. Standard 1976 atmosphere over a black surface are shown in Figure 2. Clear-air temperature retrievals which are being developed based upon MTS data are expected to have vertical resolutions on the order of 2.5 km and RMS temperature errors on the order of 1 K. Such soundings are

only moderately perturbed by nonprecipitating clouds. Strong, frequency-dependent scattering of millimeter-wave radiation by large graupel particles in convective storms will perturb radiances, providing imagery of storm cores
through enshrouding clouds. (Schwartz, et al., Spina, et al.)

Key personnel for the MTS from the Research Laboratory of Electronics of the Massachusetts Institute of Technology are Dr. Philip W. Rosenkranz, Principal Investigator, Mr. John W. Barrett, Principal Research Engineer, Mr. William J. Blackwell, Principal Research Assistant, Dr. Michael J. Schwartz, Assistant Principal. Prof. David H. Staelin will participate in his capacity at Lincoln Laboratories.

High-Resolution Interferometer Sounder

The High-Resolution Interferometer Sounder (HIS) measures upwelling infrared spectral radiance at the aircraft altitude with high absolute accuracy using a passive Michelson interferometer and precision onboard blackbody calibration sources. The instrument has a single nadir staring field of view with observed spectra obtained every six seconds. The spectra cover the range 16.6 microns to 3.3 microns with a spectral resolution of 0.3 to 0.5 cm-1. The primary use of the instrument is as an atmospheric sounder of temperature and water vapor. The spectra also contain important information on trace gases and surface properties. The HIS was developed by the University of Wisconsin at Madison and is a prototype instrument for advanced infrared satellite sounders.

Additional information regarding HIS may be obtained from Dr. William Smith, SSEC-CIMSS, 1225 W. Dayton St., Madison, WI 53706. E-mail: bills@ssecmail.ssec.wisc.edu

Data Availability

The U.S. Geological Survey's EROS Data Center at Sioux Falls, South Dakota serves as the archive and product distribution facility for Airborne Science Program aircraft acquired photographic and digital imagery. The photographic archive consists of photography acquired by the program from 1971 to April 1996. For information regarding photography and digital data (including areas of coverage, products, and product costs) contact EROS Data Center, Customer Services, Sioux Falls, South Dakota 57198 (Telephone: 605.594.6151).

As of April 1996 the EROS Data Center no longer receives an archive copy of newly acquired Airborne Science Program photography. Original photography is archived with the Airborne Sensor Facility at Ames Research Center. A user copy of the photography is provided to the principal investigators for each flight. Principal investigators are cited on the first page of their respective flight summary reports. For information regarding photography acquired from April 1996 to the present contact the Airborne Sensor Facility as follows:

Flight Documentation and Data Archive Searches

The following is the web site for flight documentation as published by the Airborne Sensor Facility at NASA Ames Research Center: http://asapdata.arc.nasa.gov/er-2fsr.html

Additional information regarding flight documentation to include data archive searches, data availability, sensor parameters, and areas of coverage may be obtained from the following: Airborne Sensor Facility, MS 240-6, NASA Ames Research Center, Moffett Field, CA 94035-1000, Telephone: 650.604.6252 (FAX 650.604.4987).

FLIGHT SUMMARY REPORT

Flight Number: 99-050

Calendar/Julian Date: 15 March 1999 • 074

Sensor Package: Wild-Heerbrugg RC-10
Modis Airborne Simulator (MAS)
Microwave Temperature Sounder (NAST-I)
High-Resolution Interferometer Sounder
(Scanning HIS)

Area(s) Covered: Ferry – Dryden Flight Research Center
to Truax Field, Madison Wisconsin

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

Accession #:	05324	-----	-----	-----
Sensor ID #:	023	108	122	083
Sensor Type:	RC-10	MAS 50	NAST-I	Scanning HIS
Focal Length:	6” 153.21mm	-----	-----	-----
Film Type:	Panatomic X Aerographic II EK 2412	-----	-----	-----
Filtration:	Wratten 12	-----	-----	-----
Spectral Band:	510- 700 nm	-----	-----	-----
f Stop:	5.6	-----	-----	-----
Shutter Speed:	1/250	-----	-----	-----
# of Frames:	20	-----	-----	-----
% Overlap:	60	-----	-----	-----
Quality:	Good	-----	-----	-----

Remarks: Subtract 2 seconds for correct UTC

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-050

Accession # 05324

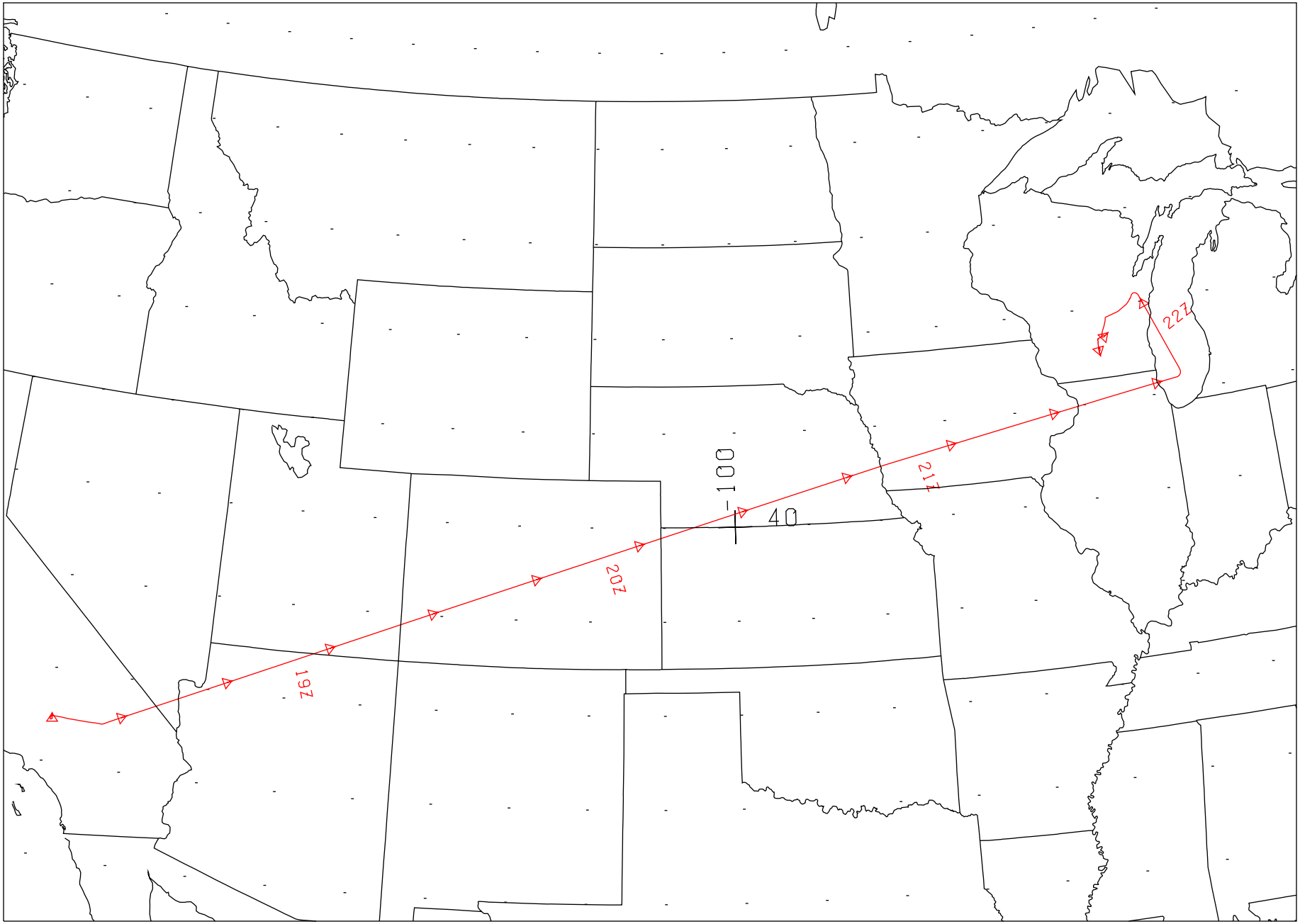
Sensor # 023

Check Points	Frame Numbers	Time (GMT-hr, min, sec) START	Time (GMT-hr, min, sec) END	Altitude, MSL feet/meters	Cloud Cover/Remarks
A - B	0305 - 0306	18:40:15	18:41:11	63000/19200	100% Cumulus
C - D	0307 -0313	21:20:12	21:25:40	68600/20900	Clear
E - F	0314 - 0318	21:44:57	21:51:45	69000/21030	Clear; frame 0318 oblique
F - G	0319 - 0324	21:52:41	21:58:51	68700/20940	Clear; frame 0319 oblique

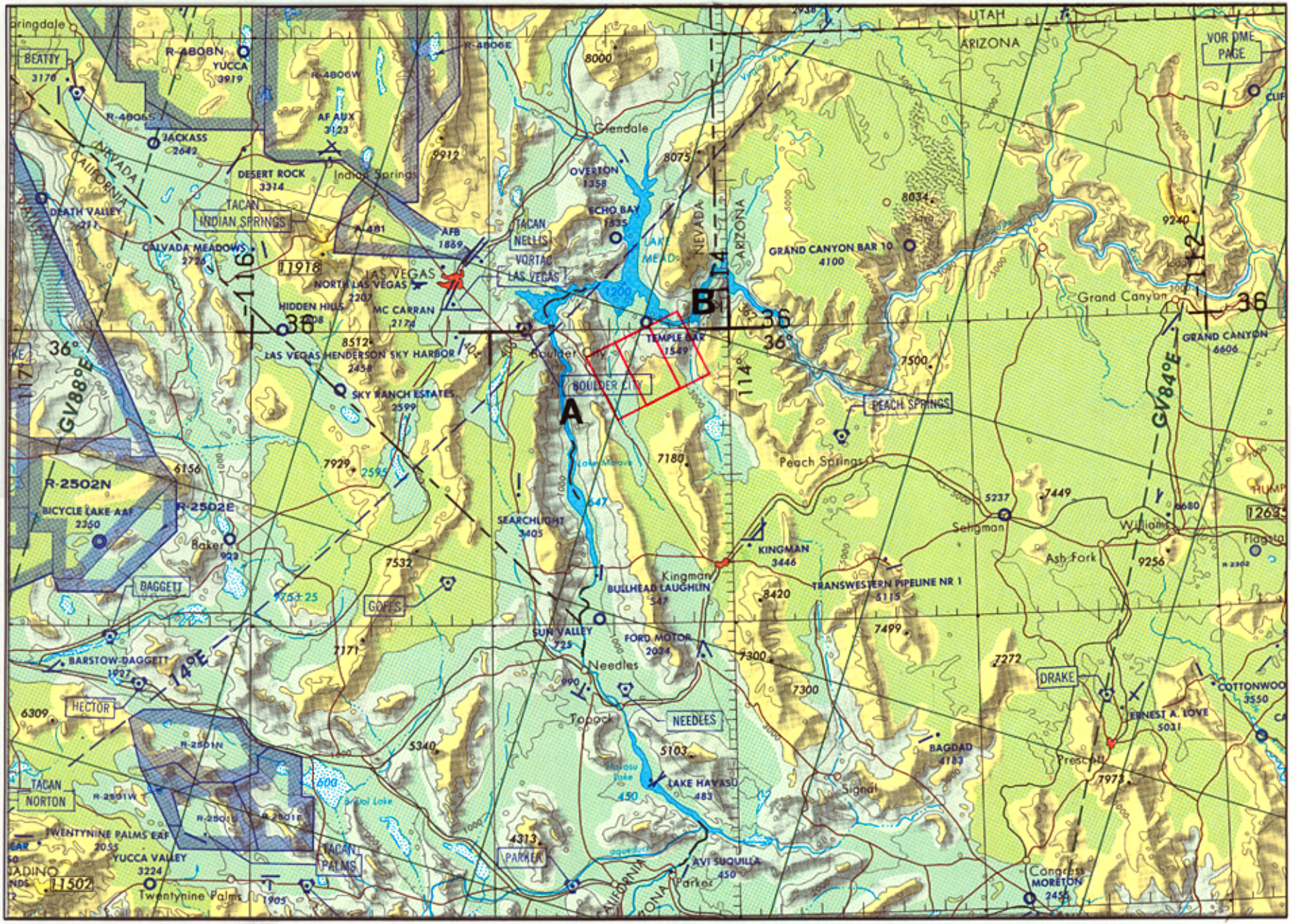
MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 15-MAR-1999 FLIGHT 99-050

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	18:40:15	35.851	-114.388	40.9	154.1	64.41	18:53:38	36.521	-112.629	40.0	161.9	4988
2	18:53:39	36.518	-112.637	40.0	161.9	65.45	19:07:00	37.148	-110.886	39.6	169.9	4994
3	19:07:02	37.150	-110.882	39.6	169.9	67.14	19:20:24	37.755	-109.102	39.8	178.0	4995
4	19:20:25	37.755	-109.103	39.8	178.0	67.76	19:33:47	38.330	-107.292	40.5	186.0	4996
5	19:33:48	38.331	-107.287	40.5	186.0	68.24	19:47:07	38.878	-105.441	41.7	193.7	4976
6	19:47:11	38.882	-105.431	41.7	193.7	69.18	20:00:33	39.397	-103.560	43.4	201.0	4986
7	20:00:34	39.396	-103.565	43.4	201.0	70.77	20:13:56	39.883	-101.666	45.5	207.9	4996
8	20:13:57	39.885	-101.660	45.5	207.9	71.13	20:27:19	40.339	-99.743	48.0	214.3	4996
9	20:27:20	40.338	-99.746	48.0	214.3	72.75	20:40:42	40.765	-97.785	50.8	220.3	4996
10	20:40:43	40.767	-97.772	50.8	220.3	74.54	20:54:03	41.159	-95.787	53.8	225.9	4984
11	20:54:06	41.162	-95.776	53.8	225.9	75.99	21:07:28	41.488	-93.771	57.0	231.1	4996
12	21:07:29	41.489	-93.768	57.0	231.1	78.44	21:20:51	41.777	-91.765	60.4	235.9	4996
13	21:20:52	41.777	-91.766	60.4	235.9	79.52	21:34:14	42.030	-89.752	64.0	240.5	4997
14	21:34:15	42.034	-89.744	64.0	240.5	79.66	21:50:53	42.295	-87.249	68.5	245.8	6221
15	21:53:09	42.484	-87.143	69.2	246.4	341.64	21:59:02	43.109	-87.453	70.2	247.1	2200

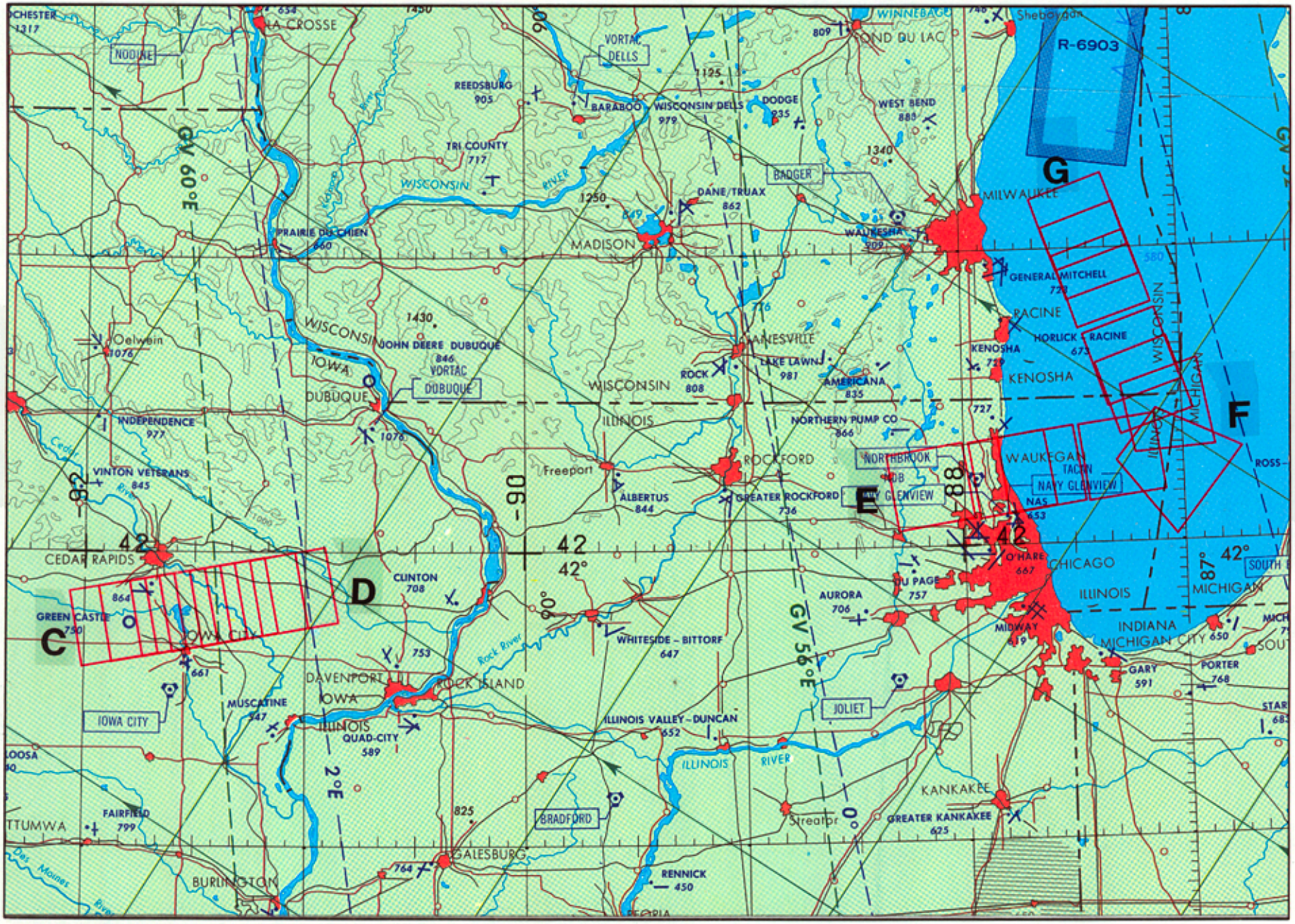
NUMBER OF FILES FOR THIS FLIGHT = 15
TOTAL NUMBER OF SCAN LINES = 73317
DATE THESE FILES WERE PROCESSED = 28-Apr-99
DATE THIS LIST WAS CREATED = 29-Apr-99
GRANULE VERSION = 9



FLIGHT 99-050 15 MARCH 1999 A/C 806 MAS50 / SCANNING HIS / RC-10 / NAST-I



FLIGHT 99-050 15 MARCH 1999 A/C 806 RC-10 JNC 43



FLIGHT 99-050 15 MARCH 1999 A/C 806 RC-10 JNC 44

FLIGHT SUMMARY REPORT

Flight Number: 99-051

Calendar/Julian Date: 18 March 1999 • 077

Sensor Package: Wild-Heerbrugg RC-10
Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I/NAST-M)
High-Resolution Interferometer Sounder
(Scanning HIS)

Area(s) Covered: Southern Wisconsin (Madison)

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

Accession #:	05325	-----	-----	-----	-----	-----
Sensor ID #:	034	108	118	122	123	083
Sensor Type:	RC-10	MAS 50	VIS	NAST-I	NAST-M	Scanning HIS
Focal Length:	12” 304.66mm	-----	-----	-----	-----	-----
Film Type:	Panatomic X Aerographic II EK 2412	-----	-----	-----	-----	-----
Filtration:	Wratten 12	-----	-----	-----	-----	-----
Spectral Band:	510- 700 nm	-----	-----	-----	-----	-----
f Stop:	11	-----	-----	-----	-----	-----
Shutter Speed:	1/250	-----	-----	-----	-----	-----
# of Frames:	82	-----	-----	-----	-----	-----
% Overlap:	60	-----	-----	-----	-----	-----
Quality:	Excellent	-----	-----	-----	-----	-----

Remarks: Subtract 88 seconds for correct UTC

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-051

Accession # 05325

Sensor # 034

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	8423 - 8449	19:41:37	19:53:13	68000/20730	Clear
A - B	8450 -8476	20:24:33	20:36:06	68000/20730	Clear
A - B	8477 - 8504	21:06:36	21:18:35	68000/20730	Clear

MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 18-MAR-1999 FLIGHT 99-051

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	19:25:29	43.906	-87.606	48.7	209.2	142.40	19:32:17	43.283	-86.901	49.0	212.4	2540
2	19:35:11	43.079	-87.072	49.4	213.3	272.81	19:52:16	43.075	-89.643	50.0	215.3	6390
3	19:56:18	42.787	-89.631	50.0	216.8	88.65	20:13:05	42.787	-87.003	53.3	224.4	6273
4	20:17:06	43.072	-87.000	54.2	225.2	274.10	20:32:21	43.078	-89.290	55.0	226.8	5689
5	20:32:24	43.074	-89.297	55.0	226.8	270.59	20:34:50	43.071	-89.656	55.1	227.1	910
6	20:38:47	42.788	-89.641	55.3	228.4	89.24	20:55:31	42.788	-87.006	59.2	235.0	6254
7	20:59:38	43.076	-87.028	60.2	235.7	273.17	21:17:08	43.077	-89.621	61.2	237.3	6540
8	21:21:14	42.788	-89.575	61.6	238.5	88.22	21:37:21	42.787	-87.026	65.8	244.1	6028

NUMBER OF FILES FOR THIS FLIGHT = 8
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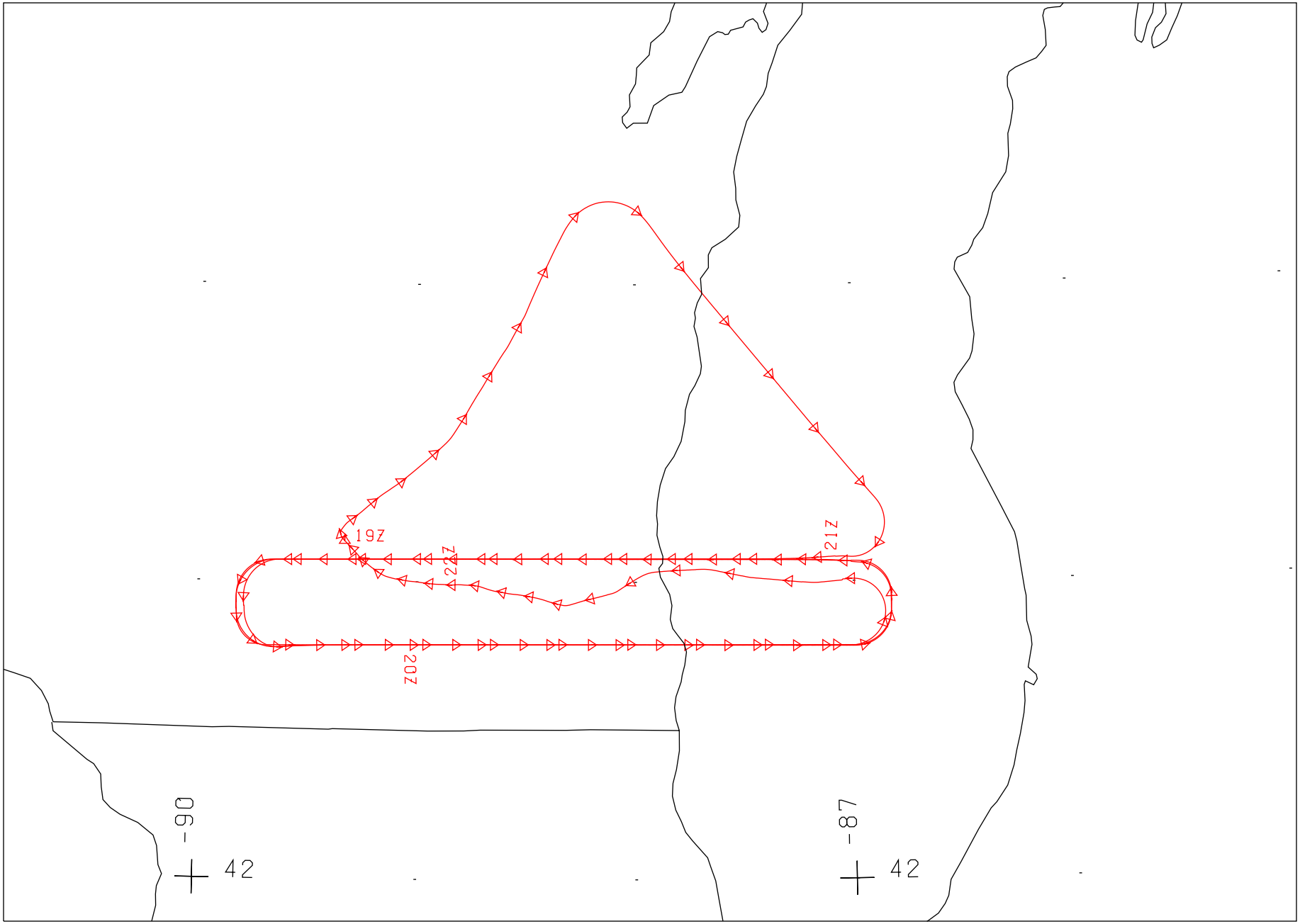
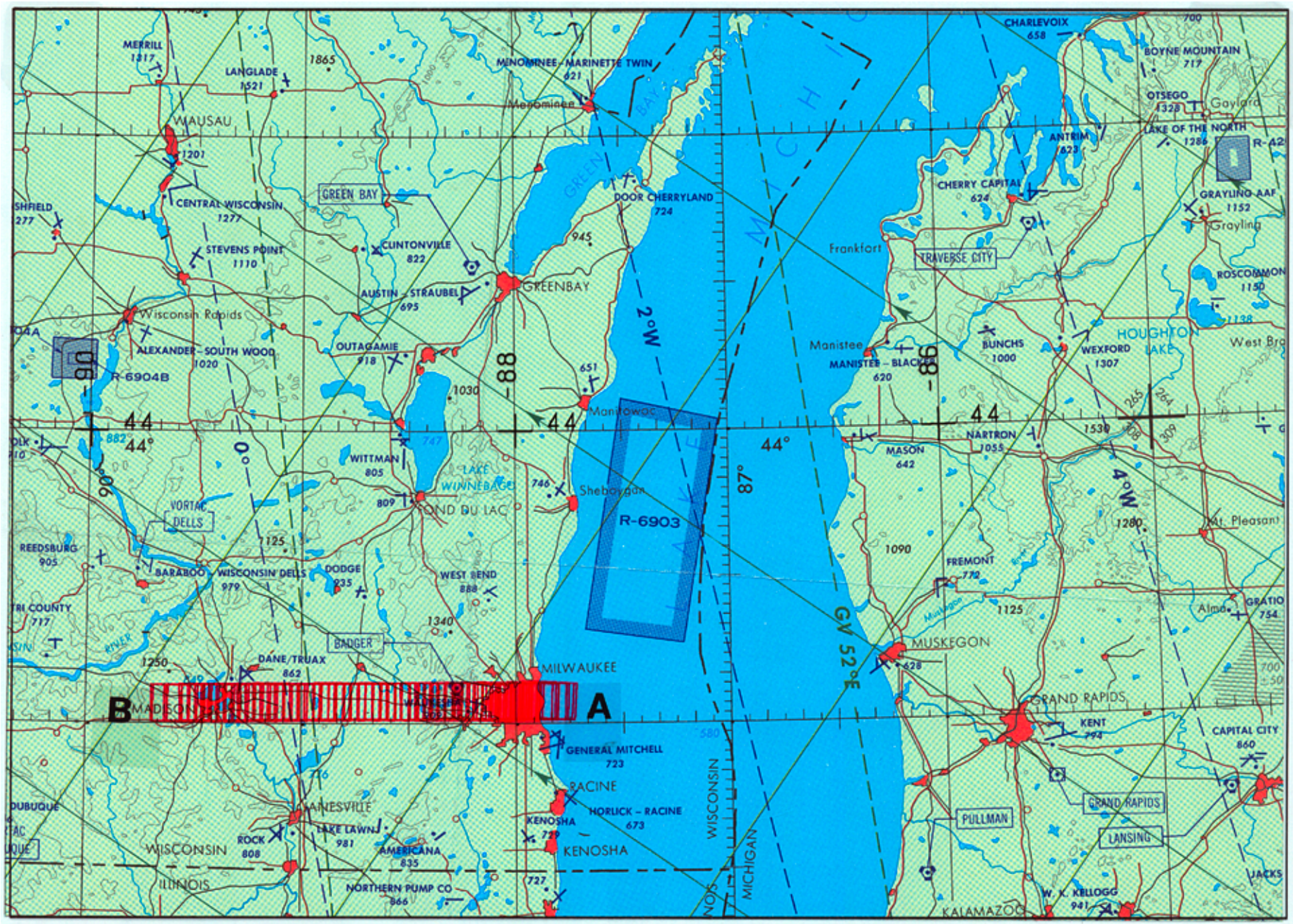
DATE THESE FILES WERE PROCESSED = 28-Apr-99
DATE THIS LIST WAS CREATED = 29-Apr-99
GRANULE VERSION = 9



FLIGHT 99-051 18 MARCH 1999 A/C 806 MAS50 / NAST-I / NAST-M / SCANNING HIS / VIS / RC-10



FLIGHT 99-051 18 MARCH 1999 A/C 806 RC-10 (12") JNC 44

FLIGHT SUMMARY REPORT

Flight Number: 99-053

Calendar/Julian Date: 20-21 March 1999 • 079-080

Sensor Package: Dual Wild-Heerbrugg RC-10
Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I/NAST-M)
High-Resolution Interferometer Sounder
(Scanning HIS)

Area(s) Covered: Wisconsin to Canada

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

Accession #:	05326	05327	-----	-----	-----
Sensor ID #:	034	023	108	118	122
Sensor Type:	RC-10	RC-10	MAS 50	VIS	NAST-I
Focal Length:	12” 304.66mm	6” 153.21mm	-----	-----	-----
Film Type:	Panatomic X Aerographic II EK 2412	Panatomic X Aerographic II EK 2412	-----	-----	-----
Filtration:	Wratten 12	Wratten 12	-----	-----	-----
Spectral Band:	510- 700 nm	510- 700 nm	-----	-----	-----
f Stop:	11	5.6	-----	-----	-----
Shutter Speed:	1/250	1/175	-----	-----	-----
# of Frames:	131	22	-----	-----	-----
% Overlap:	60	60	-----	-----	-----
Quality:	Excellent	Excellent	-----	-----	-----
Remarks:	Subtract 91 seconds for correct UTC	Subtract 4 seconds for correct UTC			

SENSOR DATA

Accession #:	-----	-----
Sensor ID #:	123	083
Sensor Type:	NAST-M	Scanning HIS
Focal Length:	-----	-----
Film Type:	-----	-----
Filtration:	-----	-----
Spectral Band:	-----	-----
f Stop:	-----	-----
Shutter Speed:	-----	-----
# of Frames:	-----	-----
% Overlap:	-----	-----
Quality:	-----	-----
Remarks:		

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-053

Accession # 05326

Sensor # 034

Check Points	Frame Numbers	Time (GMT-hr, min, sec) START	Time (GMT-hr, min, sec) END	Altitude, MSL feet/meters	Cloud Cover/Remarks
A - B	8521 -8551	21:29:00	21:42:31	62000/18900	20 - 90% Cumulus frames 8540 - 8548; frames 8551 oblique
B - C	8552 -8567	21:42:58	21:49:54	65500/20000	10 - 40% Cumulus frames 8556 - 8563; 40 - 70% Cumulus frames 8564-8567; frame 8567 oblique
C - D	8568 - 8651	21:50:22	22:28:34	66300/20200	20 - 40 % Cumulus frames 8568 - 8593; 50 - 100% Cumulus frames 8594 - 8651

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-053

Accession # 05327

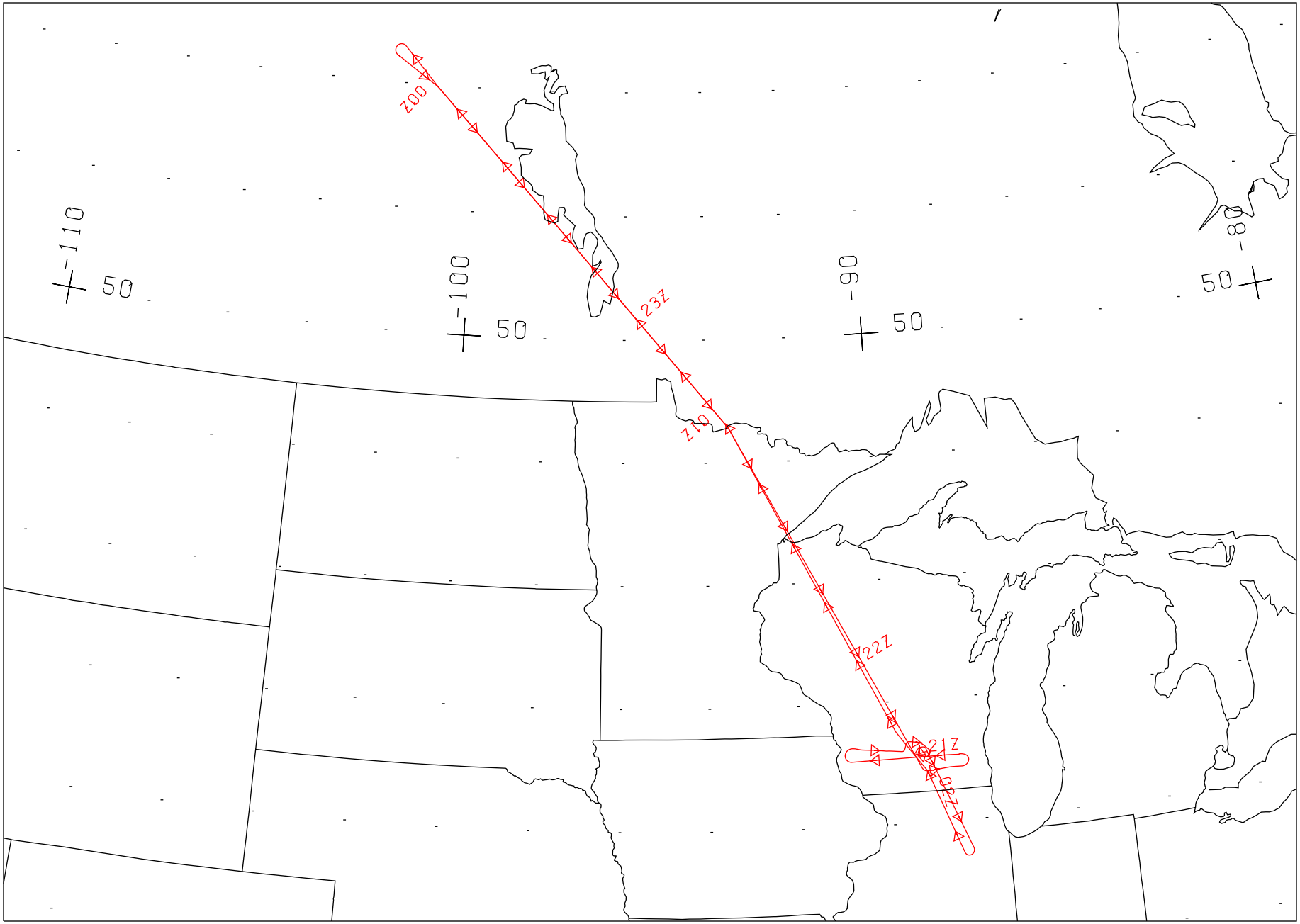
Sensor # 023

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	0347 -0361	21:27:33	21:40:44	62000/18900	10-80% Cumulus frames 0356 - 0361; frame 0361 oblique
B - C	0362 - 0368	21:41:40	21:47:18	65500/20000	20 - 60% Cumulus frames 0364 - 0368

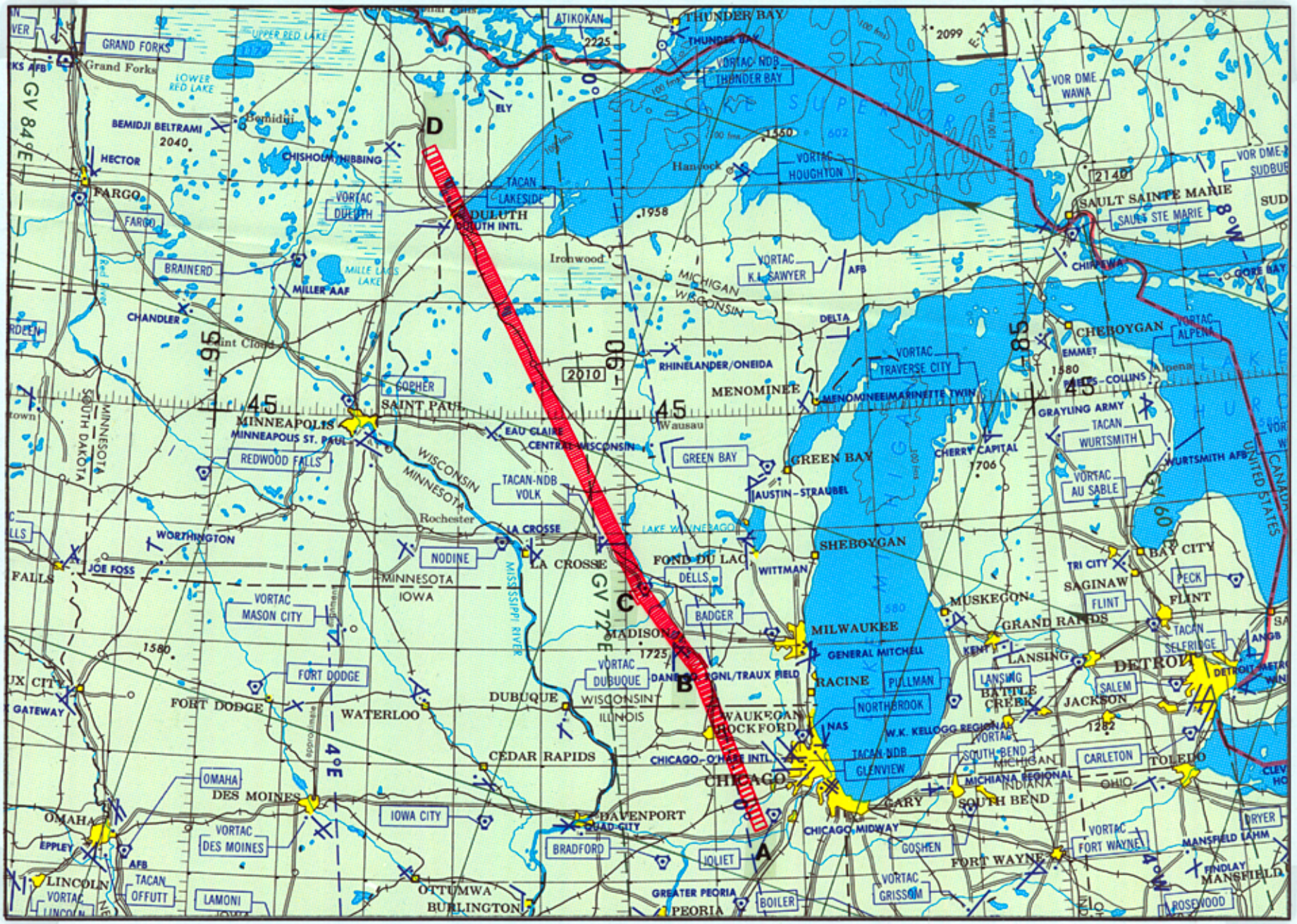
MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 20-MAR-1999 FLIGHT 99-053

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	23:25:58	52.454	-98.649	78.7	254.7	316.95	23:52:10	54.585	-102.061	81.0	257.0	9789
2	00:02:17	53.967	-101.073	82.9	259.4	133.25	00:17:33	52.678	-99.001	86.2	264.3	5705
3	00:17:34	52.676	-98.998	86.2	264.3	136.06	00:32:50	51.354	-97.047	89.7	268.9	5705
4	00:32:53	51.349	-97.044	89.7	268.9	137.83	00:46:05	50.175	-95.437	92.8	272.7	4870
5	00:46:06	50.168	-95.429	92.8	272.7	139.02	00:59:08	48.998	-93.929	96.0	276.2	4871
6	01:42:25	44.538	-90.394	106.5	286.2	155.77	01:45:15	44.235	-90.187	107.2	286.9	1060
7	01:53:11	43.968	-89.999	108.8	288.4	156.44	01:57:45	42.954	-89.337	110.3	289.5	1692
8	02:10:31	43.074	-87.921	113.5	293.4	270.61	02:15:34	43.067	-89.607	113.2	293.1	1882

NUMBER OF FILES FOR THIS FLIGHT = 8
TOTAL NUMBER OF SCAN LINES = 35574
DATE THESE FILES WERE PROCESSED = 19-May-99
DATE THIS LIST WAS CREATED = 19-May-99
GRANULE VERSION = 9



FLIGHT 99-053 20-21 MARCH 1999 A/C 806 MAS50 / NAST-I / NAST-M / SCANNING HIS / VIS / DUAL RC-10



FLIGHT 99-053 20 MARCH 1999 A/C 806 RC-10 (12") GNC-2

FLIGHT SUMMARY REPORT

Flight Number: 99-054

Calendar/Julian Date: 21-22 March 1999 • 080-081

Sensor Package: Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I/NAST-M)
High-Resolution Interferometer Sounder
(Scanning HIS)

Area(s) Covered: Wisconsin, Lake Michigan

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

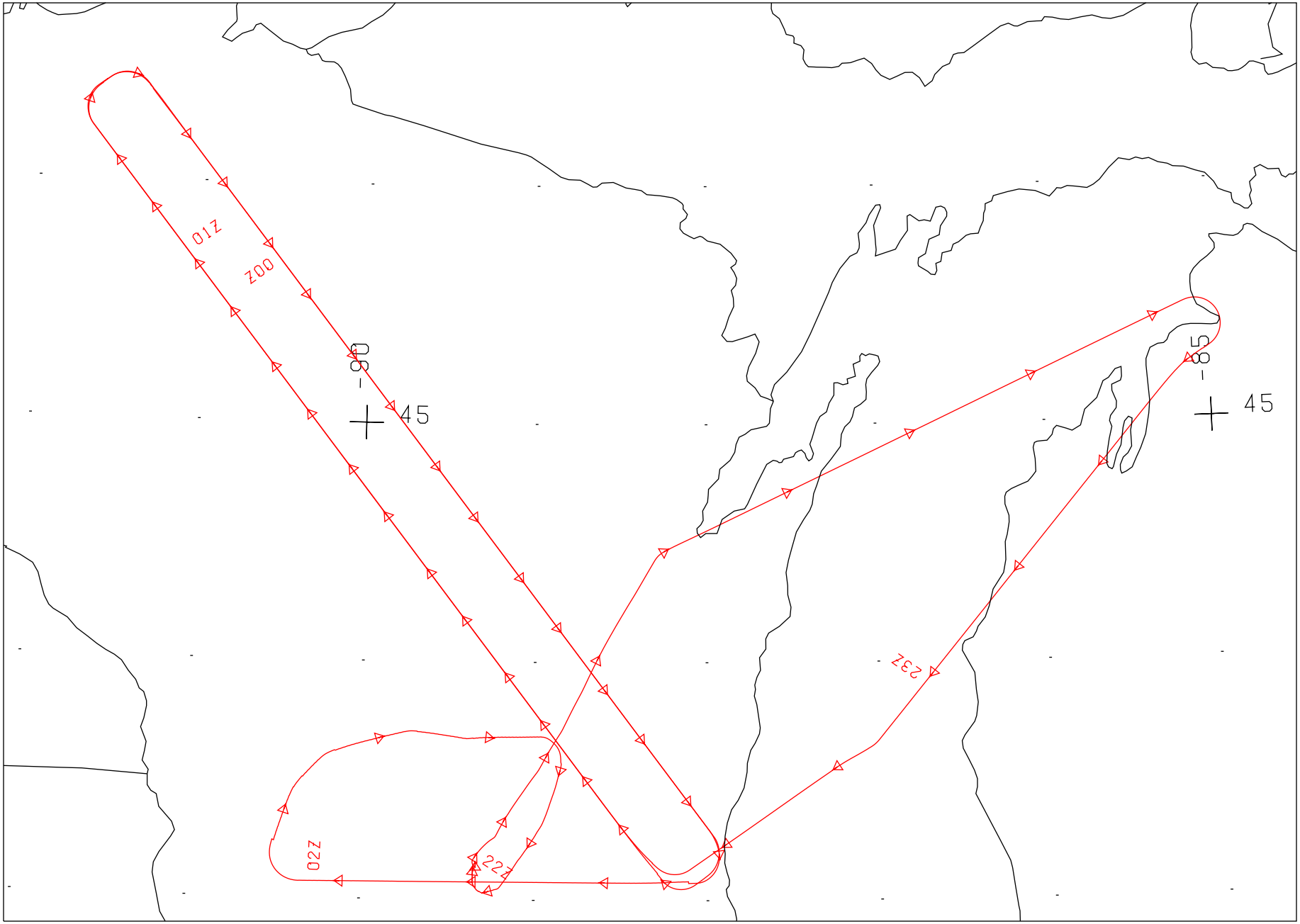
Accession #:	-----	-----	-----	-----	-----
Sensor ID #:	108	118	122	123	083
Sensor Type:	MAS 50	VIS	NAST-I	NAST-M	Scanning HIS
Focal Length:	-----	-----	-----	-----	-----
Film Type:	-----	-----	-----	-----	-----
Filtration:	-----	-----	-----	-----	-----
Spectral Band:	-----	-----	-----	-----	-----
f Stop:	-----	-----	-----	-----	-----
Shutter Speed:	-----	-----	-----	-----	-----
# of Frames:	-----	-----	-----	-----	-----
% Overlap:	-----	-----	-----	-----	-----
Quality:	-----	-----	-----	-----	-----

Remarks:

MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 21-MAR-1999 FLIGHT 99-054

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	22:25:43	44.758	-87.405	73.8	253.8	63.39	22:41:03	45.484	-85.158	78.1	258.2	5729
2	22:45:35	45.188	-85.220	78.7	258.8	223.41	23:02:53	43.682	-86.993	80.2	260.9	6455
3	23:04:50	43.556	-87.248	80.4	261.1	238.49	23:11:22	43.133	-88.090	80.9	261.8	2433
4	23:12:49	43.134	-88.298	81.2	262.1	322.96	23:32:36	44.859	-90.134	83.6	264.1	7394
5	23:32:39	44.854	-90.130	83.6	264.1	322.68	23:48:33	46.213	-91.674	85.4	265.7	5934
6	00:29:56	43.107	-88.279	95.4	275.0	322.35	00:39:30	43.941	-89.151	96.4	276.2	3582
7	00:39:34	43.952	-89.143	96.5	276.2	323.62	01:06:05	46.222	-91.669	99.0	279.5	9912
8	01:10:07	46.381	-91.331	99.7	280.2	140.98	01:26:41	44.852	-89.609	104.0	284.3	6193
9	01:26:42	44.851	-89.609	104.0	284.3	142.31	01:43:17	43.303	-87.981	108.5	288.2	6201
10	01:46:27	43.076	-88.159	109.0	288.8	271.65	02:00:37	43.071	-90.319	109.9	289.9	5246

NUMBER OF FILES FOR THIS FLIGHT = 10
TOTAL NUMBER OF SCAN LINES = 59079
DATE THESE FILES WERE PROCESSED = 28-Apr-99
DATE THIS LIST WAS CREATED = 29-Apr-99
GRANULE VERSION = 9



FLIGHT 99-054 21-22 MARCH 1999 A/C 806 MAS50 / NAST-I / NAST-M / SCANNING HIS / VIS / RC-10

FLIGHT SUMMARY REPORT

Flight Number: 99-055

Calendar/Julian Date: 25-26 March 1999 • 084-085

Sensor Package: Dual Wild-Heerbrugg RC-10
Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I/NAST-M)
High-Resolution Interferometer Sounder
(Scanning HIS)

Area(s) Covered: Wisconsin/Lake Superior

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

Accession #:	05328	05330	-----	-----	-----
Sensor ID #:	023	034	108	118	122
Sensor Type:	RC-10	RC-10	MAS 50	VIS	NAST-I
Focal Length:	6” 153.21mm	12” 304.66mm	-----	-----	-----
Film Type:	Panatomic X Aerographic II EK 2412	Panatomic X Aerographic II EK 2412	-----	-----	-----
Filtration:	Wratten 12	Wratten 12	-----	-----	-----
Spectral Band:	510- 700 nm	510- 700 nm	-----	-----	-----
f Stop:	5.6	8	-----	-----	-----
Shutter Speed:	1/175	1/225	-----	-----	-----
# of Frames:	4	6	-----	-----	-----
% Overlap:	60	60	-----	-----	-----
Quality:	Excellent	Excellent	-----	-----	-----
Remarks:	Subtract 4 seconds for correct UTC	Subtract 87 seconds for correct UTC			

SENSOR DATA

Accession #:	-----	-----
Sensor ID #:	123	083
Sensor Type:	NAST-M	Scanning HIS
Focal Length:	-----	-----
Film Type:	-----	-----
Filtration:	-----	-----
Spectral Band:	-----	-----
f Stop:	-----	-----
Shutter Speed:	-----	-----
# of Frames:	-----	-----
% Overlap:	-----	-----
Quality:	-----	-----
Remarks:		

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-055

Accession # 05328

Sensor # 023

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	0380 - 0383	22:49:43	22:51:35	52000/15850	Clear

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-055

Accession # 05330

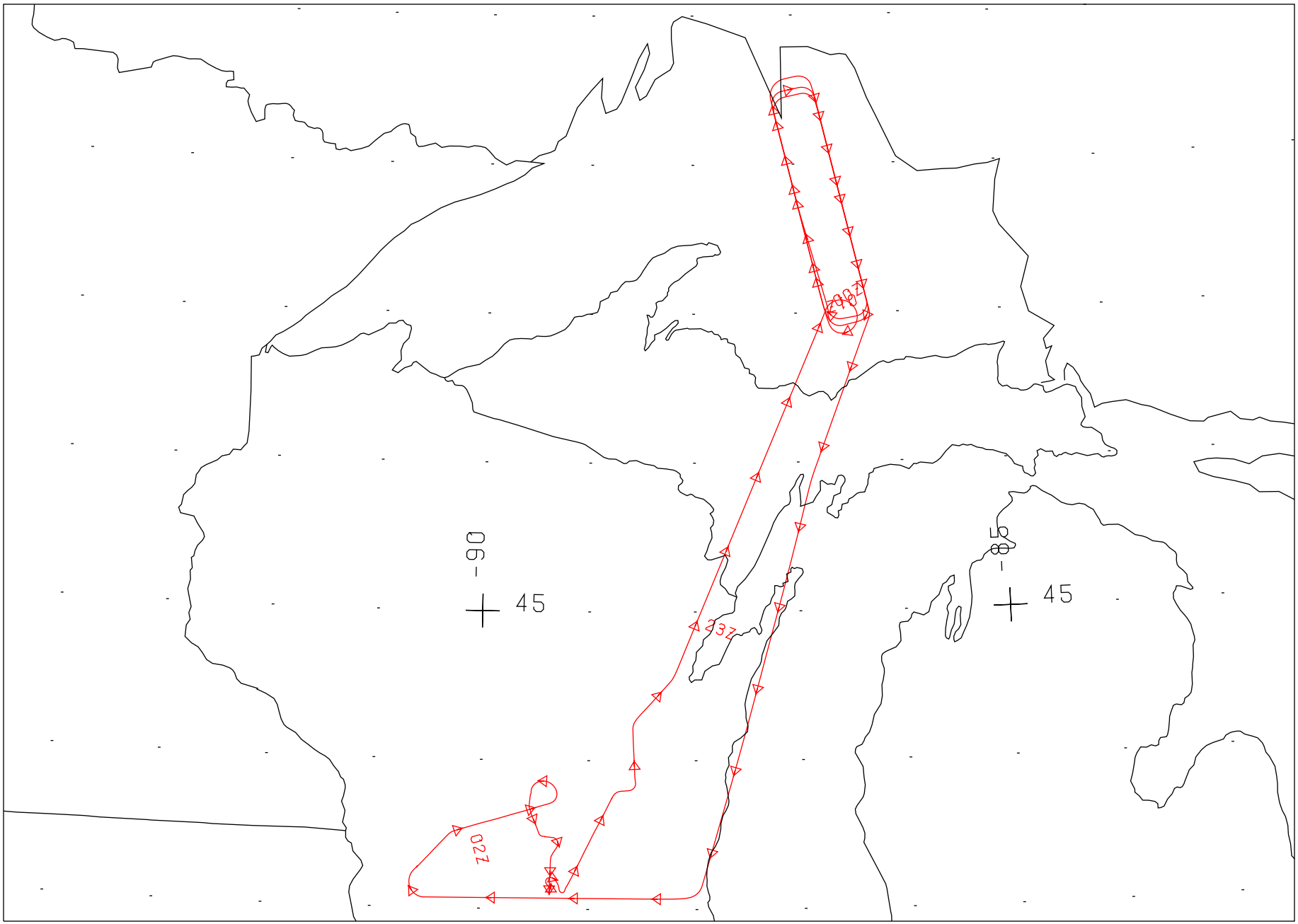
Sensor # 034

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	8669 - 8674	22:51:13	22:53:08	52000/15852	Clear

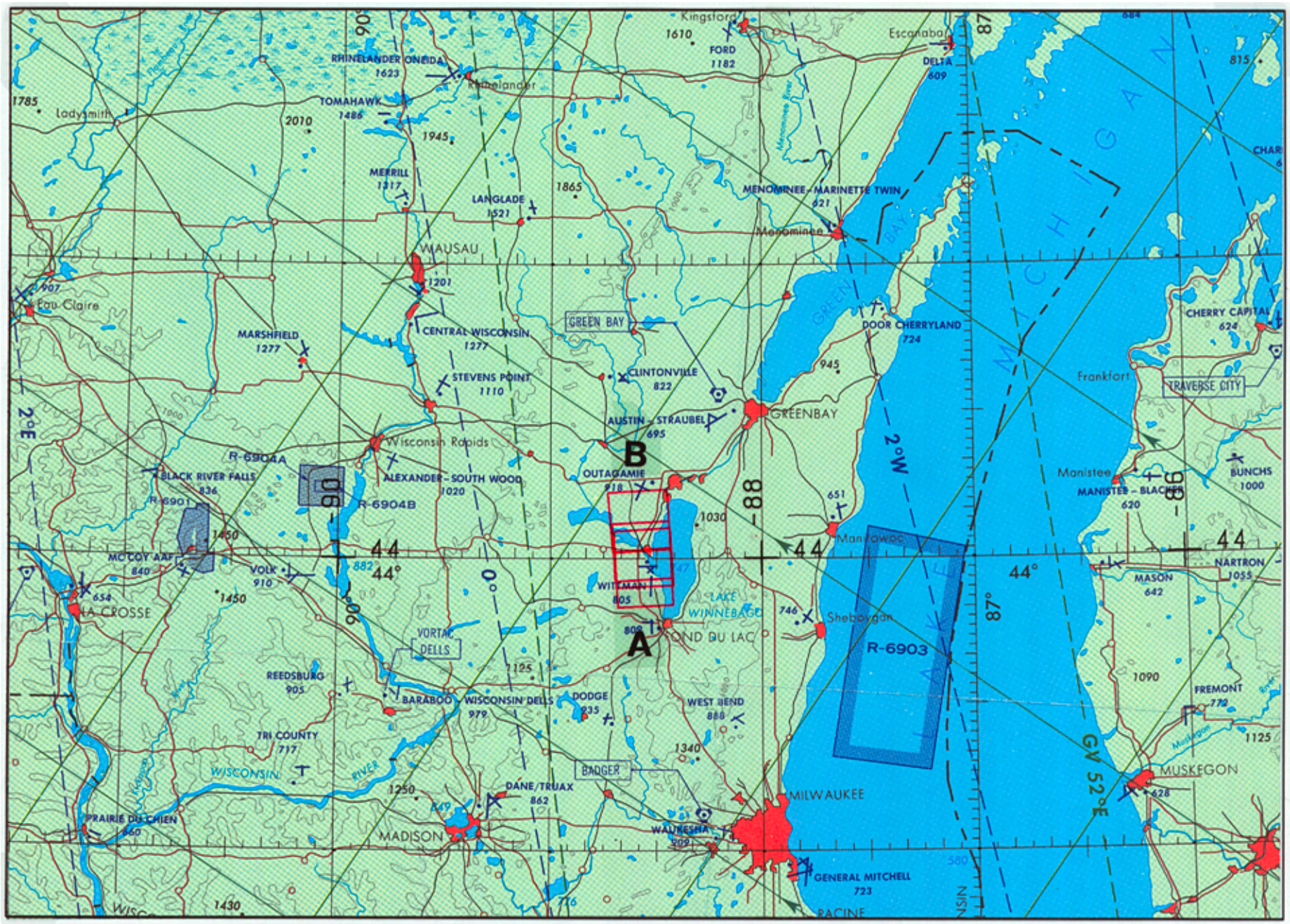
MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 25-MAR-1999 FLIGHT 99-055

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	23:17:33	46.665	-86.913	82.5	264.8	21.64	23:21:02	47.015	-86.691	83.3	265.6	1301
2	23:26:44	46.969	-86.685	84.3	266.6	345.62	23:40:27	48.424	-87.195	86.3	268.7	5129
3	23:44:07	48.519	-86.779	86.9	269.4	166.92	23:56:49	47.088	-86.290	89.4	272.1	4755
4	00:00:29	47.050	-86.684	90.2	272.5	344.14	00:13:01	48.372	-87.188	91.9	274.5	4687
5	00:16:39	48.437	-86.755	92.5	275.2	166.75	00:24:21	47.579	-86.458	94.1	276.8	2880
6	00:24:24	47.573	-86.457	94.1	276.8	167.99	00:29:02	47.046	-86.279	95.1	277.7	1734
7	00:32:39	46.990	-86.694	95.7	278.4	346.38	00:45:20	48.334	-87.165	97.3	280.6	4743
8	00:48:52	48.406	-86.741	97.8	281.3	168.14	01:01:02	47.023	-86.268	100.4	283.7	4550
9	01:01:41	46.941	-86.283	100.5	283.9	201.89	01:11:41	45.866	-86.875	102.1	285.1	3740
10	01:11:43	45.870	-86.864	102.1	285.1	196.24	01:31:12	43.741	-87.699	105.4	287.7	7286
11	01:31:16	43.729	-87.708	105.5	287.7	197.49	01:36:22	43.162	-87.937	106.4	288.3	1908
12	01:37:59	43.073	-88.134	106.6	288.6	272.80	01:53:13	43.071	-90.460	107.6	289.7	5703

NUMBER OF FILES FOR THIS FLIGHT = 12
TOTAL NUMBER OF SCAN LINES = 48416
DATE THESE FILES WERE PROCESSED = 28-Apr-99
DATE THIS LIST WAS CREATED = 29-Apr-99
GRANULE VERSION = 9



FLIGHT 99-055 25-26 MARCH 1999 A/C 806 MAS50 / NAST-I / NAST-M / SCANNING HIS / VIS / DUAL RC-10



FLIGHT 99-055 25 MARCH 1999 A/C 806 RC-10 (6") JNC 44

FLIGHT SUMMARY REPORT

Flight Number: 99-056

Calendar/Julian Date: 26-27 March 1999 • 085-086

Sensor Package: Wild-Heerbrugg RC-10
Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I/NAST-M)
High-Resolution Interferometer Sounder
(Scanning HIS)

Area(s) Covered: Wisconsin to Canada

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

Accession #:	05329	-----	-----	-----	-----	-----
Sensor ID #:	034	108	118	122	123	083
Sensor Type:	RC-10	MAS 50	VIS	NAST-I	NAST-M	Scanning HIS
Focal Length:	6” 153.21mm	-----	-----	-----	-----	-----
Film Type:	Panatomic X Aerographic II EK 2412	-----	-----	-----	-----	-----
Filtration:	Wratten 12	-----	-----	-----	-----	-----
Spectral Band:	510- 700 nm	-----	-----	-----	-----	-----
f Stop:	4	-----	-----	-----	-----	-----
Shutter Speed:	1/175	-----	-----	-----	-----	-----
# of Frames:	53	-----	-----	-----	-----	-----
% Overlap:	60	-----	-----	-----	-----	-----
Quality:	Excellent	-----	-----	-----	-----	-----

Remarks: Subtract 4 seconds for correct UTC

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-056

Accession # 05329

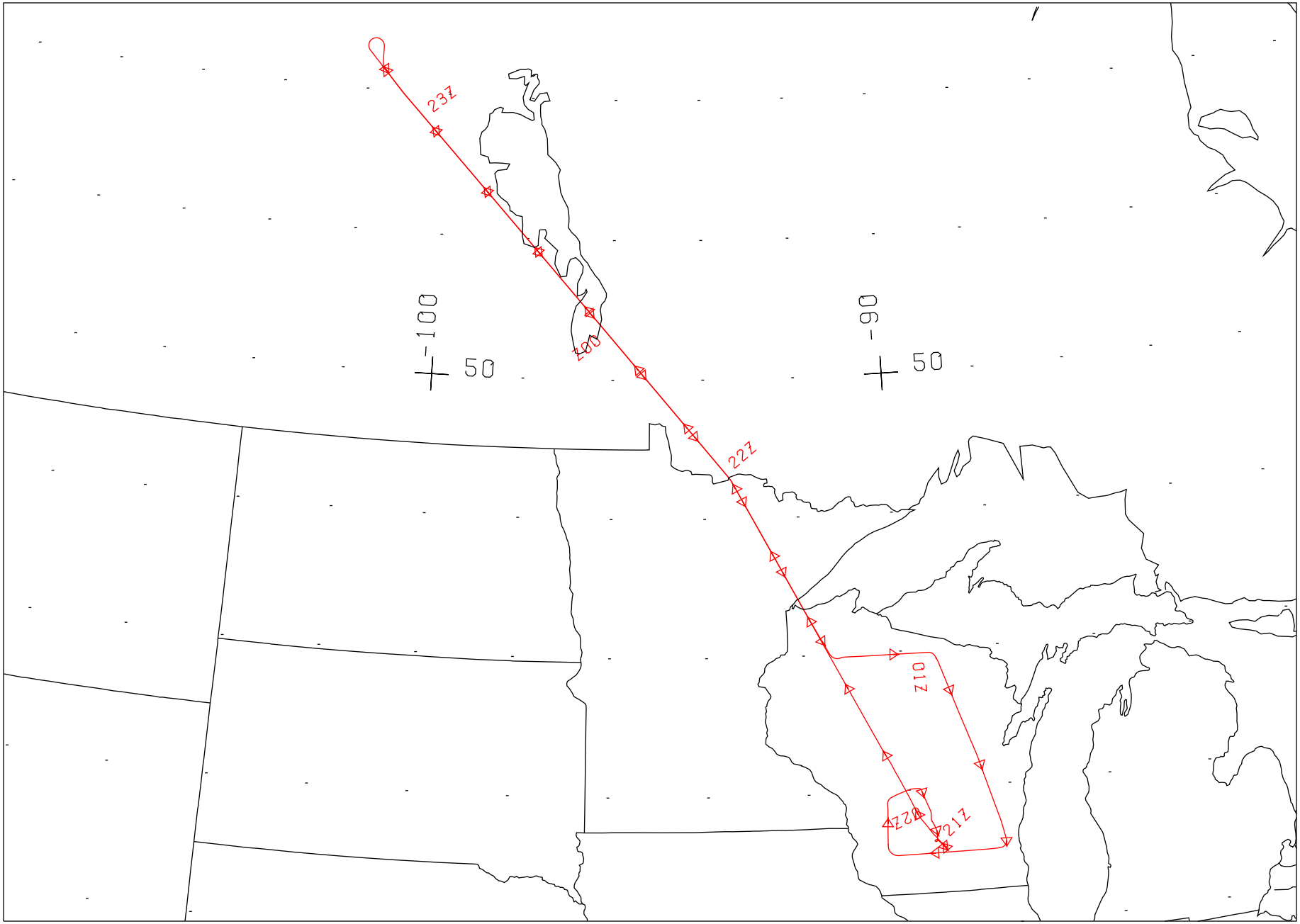
Sensor # 023

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	0386 - 0419	21:27:06	21:58:53	66000/20120	Clear
B - C	0420 - 0438	22:00:40	22:16:31	67000/20420	Clear; film transport without shutter function frame 0425

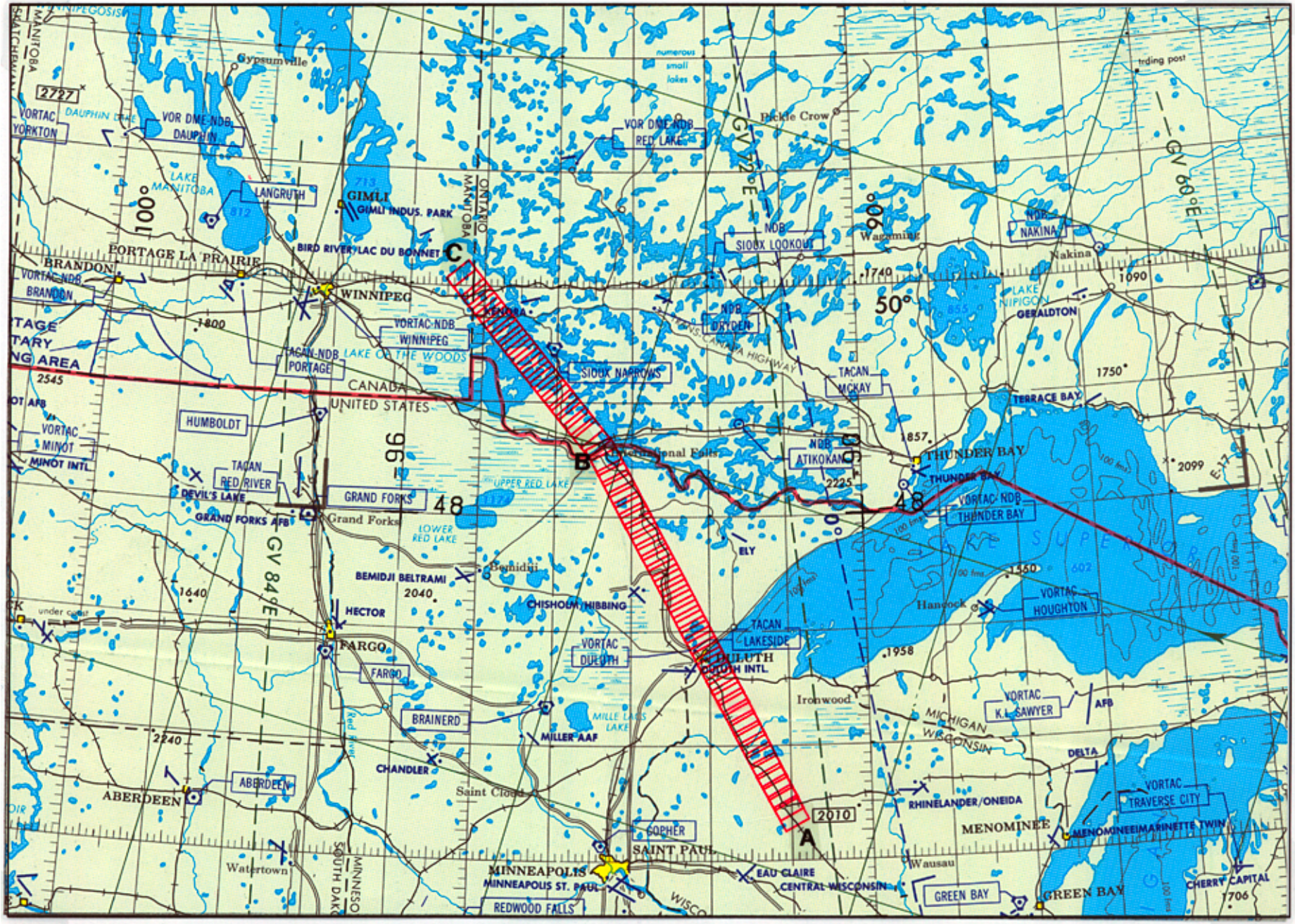
MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 26-MAR-1999 FLIGHT 99-056

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	21:57:16	48.363	-93.240	65.7	243.6	332.73	21:58:58	48.533	-93.377	65.9	243.8	634
2	21:59:30	48.600	-93.400	66.0	243.8	320.75	22:31:47	51.320	-96.958	69.8	246.8	12067
3	22:31:48	51.323	-96.952	69.8	246.8	318.57	23:04:06	53.975	-101.040	73.0	249.5	12073
4	23:04:09	53.965	-101.083	73.0	249.4	317.89	23:11:06	54.536	-101.977	73.6	250.0	2604
5	23:17:46	54.298	-101.592	74.4	251.6	140.62	23:21:16	53.996	-101.141	75.1	252.8	1309
6	00:11:02	49.779	-94.917	86.0	268.3	140.17	00:24:12	48.601	-93.439	89.1	271.9	4923
7	00:24:38	48.551	-93.376	89.2	272.0	153.45	00:49:23	46.022	-91.437	95.0	277.9	9253
8	00:51:40	45.959	-91.119	95.7	278.7	90.16	01:02:00	45.955	-89.413	98.7	281.9	3870
9	01:03:55	45.802	-89.213	99.0	282.2	162.88	01:16:12	44.447	-88.590	101.8	284.7	4594
10	01:17:54	44.258	-88.516	102.2	285.0	167.11	01:24:19	43.538	-88.244	103.7	286.2	2401
11	01:24:51	43.478	-88.220	103.9	286.3	170.87	01:27:15	43.205	-88.145	104.4	286.8	898
12	01:28:57	43.073	-88.284	104.7	287.2	270.85	01:42:25	43.071	-90.253	105.7	288.2	4956

NUMBER OF FILES FOR THIS FLIGHT = 12
TOTAL NUMBER OF SCAN LINES = 59582
DATE THESE FILES WERE PROCESSED = 30-Apr-99
DATE THIS LIST WAS CREATED = 04-May-99
GRANULE VERSION = 9



FLIGHT 99-056 26-27 MARCH 1999 A/C 806 MAS50 / NAST-I / NAST-M / SCANNING HIS / VIS / RC-10



FLIGHT 99-056 26 MARCH 1999 A/C 806 RC-10 (6") GNC-2

FLIGHT SUMMARY REPORT

Flight Number: 99-057

Calendar/Julian Date: 29-30 March 1999 • 088-089

Sensor Package: Wild-Heerbrugg RC-10
Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I/NAST-M)
High-Resolution Interferometer Sounder
(Scanning HIS)

Area(s) Covered: Illinois/Indiana
Lake Michigan

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

Accession #:	05331	-----	-----	-----	-----	-----
Sensor ID #:	034	108	118	122	123	083
Sensor Type:	RC-10	MAS 50	VIS	NAST-I	NAST-M	Scanning HIS
Focal Length:	6” 153.21mm	-----	-----	-----	-----	-----
Film Type:	Panatomic X Aerographic II EK 2412	-----	-----	-----	-----	-----
Filtration:	Wratten 12	-----	-----	-----	-----	-----
Spectral Band:	510- 700 nm	-----	-----	-----	-----	-----
f Stop:	4	-----	-----	-----	-----	-----
Shutter Speed:	1/175	-----	-----	-----	-----	-----
# of Frames:	36	-----	-----	-----	-----	-----
% Overlap:	60	-----	-----	-----	-----	-----
Quality:	Poor	-----	-----	-----	-----	-----

Remarks: Subtract 6 seconds for correct UTC

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-057

Accession # 05331

Sensor # 023

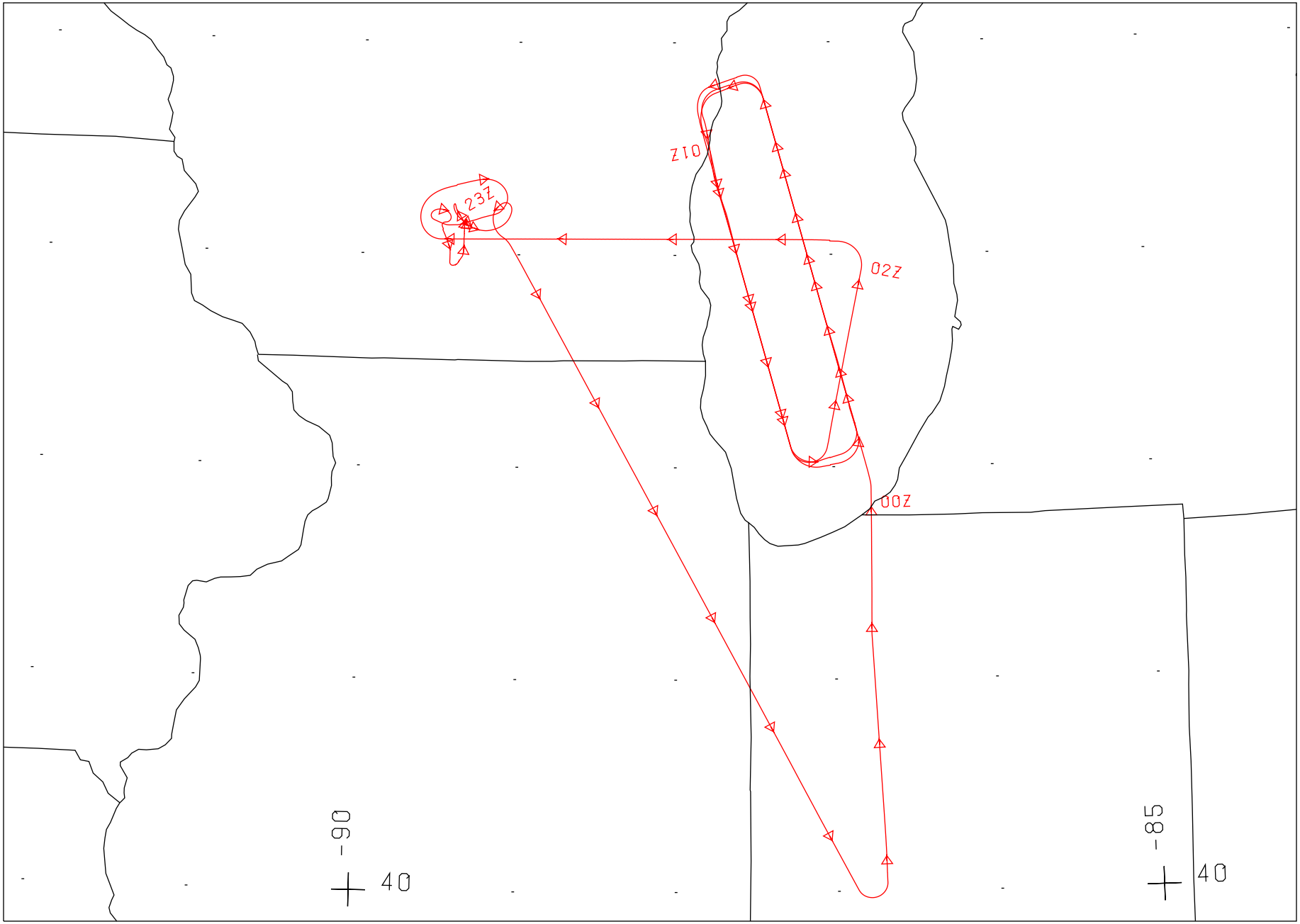
Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	0449 - 0469	23:24:14	23:42:03	65000/19800	10 - 30% Cumulus frames 0453 - 0469
C - D	0470 - 0484	23:44:33	23:57:33	65000/19800	10 - 20% Cumulus frames 0470 - 0486

Note: Photographic data acquired with extremely low sun angles, overall exposure quite thin

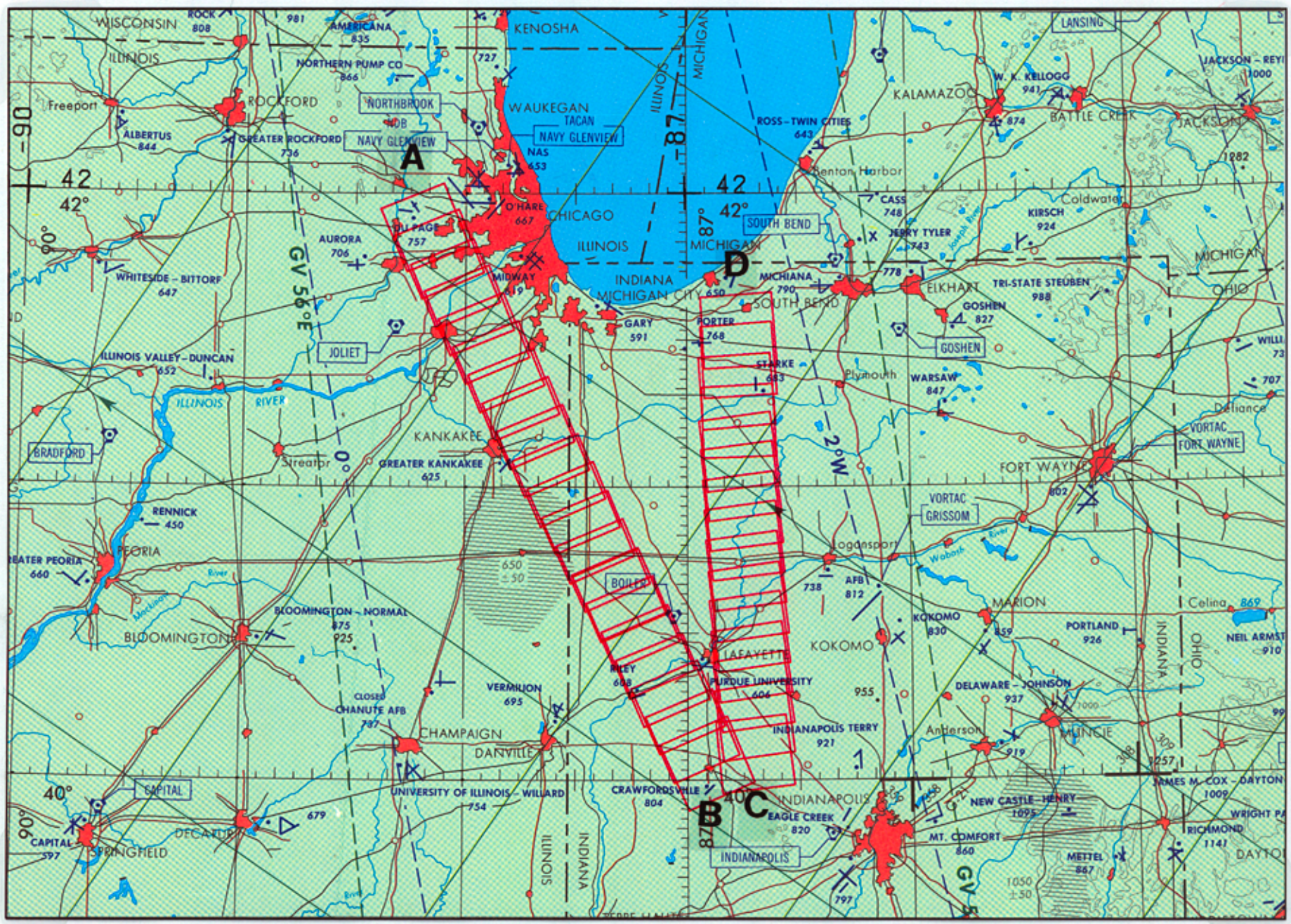
MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 29-MAR-1999 FLIGHT 99-057

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	23:23:22	41.963	-88.235	81.1	266.7	157.47	23:42:18	40.013	-86.871	85.7	270.9	7062
2	23:44:07	40.059	-86.690	86.4	271.5	352.40	23:54:34	41.208	-86.766	88.3	273.1	3907
3	00:01:15	41.941	-86.761	89.7	273.9	341.59	00:18:02	43.730	-87.411	92.2	276.3	6275
4	00:23:35	43.466	-87.755	92.7	276.8	171.85	00:24:52	43.324	-87.714	92.9	277.0	480
5	00:26:09	43.182	-87.657	93.2	277.3	170.47	00:30:13	42.740	-87.499	94.1	278.1	1521
6	00:30:16	42.734	-87.494	94.2	278.1	169.18	00:36:07	42.097	-87.262	95.5	279.2	2188
7	00:41:42	42.322	-86.895	97.0	280.7	341.43	00:54:54	43.734	-87.415	98.7	282.8	4937
8	01:01:45	43.335	-87.720	99.5	283.5	169.20	01:13:18	42.101	-87.262	102.2	285.7	4320
9	01:17:07	42.182	-86.847	103.4	287.0	341.31	01:32:10	43.789	-87.435	105.1	289.7	5629
10	01:33:25	43.838	-87.581	105.0	289.7	253.64	01:34:39	43.795	-87.754	105.1	289.8	462
11	01:37:08	43.548	-87.798	105.6	290.0	169.58	01:50:41	42.085	-87.256	108.8	292.6	5058
12	01:53:03	42.130	-87.022	109.6	293.5	8.78	02:00:01	42.921	-86.803	110.6	295.3	2606
13	02:02:03	43.072	-86.967	110.5	295.6	269.15	02:18:51	43.076	-89.346	111.7	297.0	6283

NUMBER OF FILES FOR THIS FLIGHT = 13
TOTAL NUMBER OF SCAN LINES = 50728
DATE THESE FILES WERE PROCESSED = 04-May-99
DATE THIS LIST WAS CREATED = 04-May-99
GRANULE VERSION = 9



FLIGHT 99-057 29-30 MARCH 1999 A/C 806 MAS50 / NAST-I / NAST-M / SCANNING HIS / VIS / RC-10



FLIGHT 99-057 29 MARCH 1999 A/C 806 RC-10 (6") JNC 44

FLIGHT SUMMARY REPORT

Flight Number: 99-058

Calendar/Julian Date: 31 March 1999 • 090

Sensor Package: Wild-Heerbrugg RC-10
Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I/NAST-M)
High-Resolution Interferometer Sounder
(Scanning HIS)

Area(s) Covered: Southern Wisconsin

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

Accession #:	05332	-----	-----	-----	-----	-----
Sensor ID #:	034	108	118	122	123	083
Sensor Type:	RC-10	MAS 50	VIS	NAST-I	NAST-M	Scanning HIS
Focal Length:	12” 304.66mm	-----	-----	-----	-----	-----
Film Type:	Panatomic X Aerographic II EK 2412	-----	-----	-----	-----	-----
Filtration:	Wratten 12	-----	-----	-----	-----	-----
Spectral Band:	510- 700 nm	-----	-----	-----	-----	-----
f Stop:	8	-----	-----	-----	-----	-----
Shutter Speed:	1/225	-----	-----	-----	-----	-----
# of Frames:	41	-----	-----	-----	-----	-----
% Overlap:	60	-----	-----	-----	-----	-----
Quality:	Excellent	-----	-----	-----	-----	-----

Remarks: Subtract 100 seconds for correct UTC

CAMERA FLIGHT LINE DATA
FLIGHT NO. 99-058

Accession # 05332

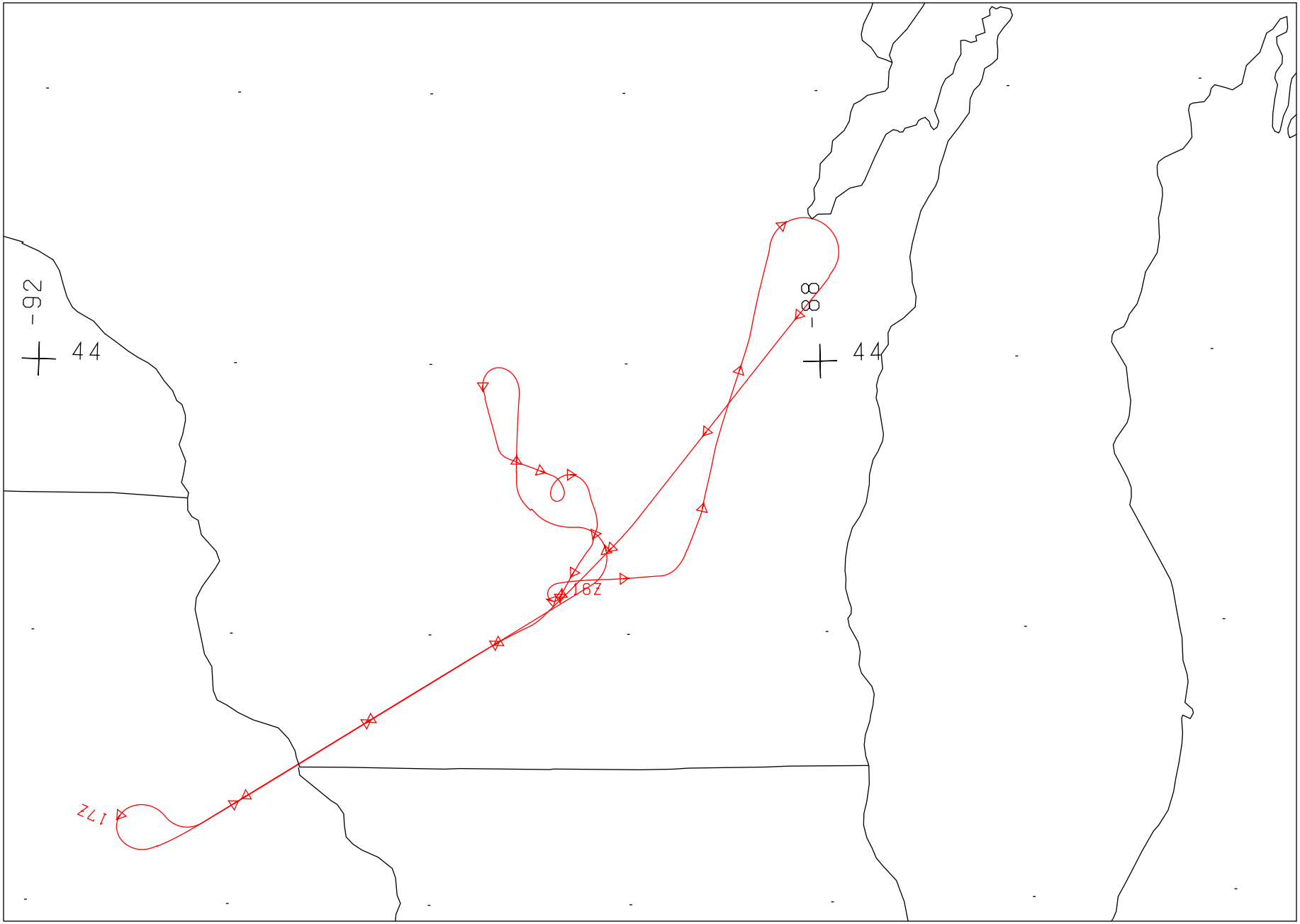
Sensor # 034

Check Points	Frame Numbers	Time (GMT-hr, min, sec)		Altitude, MSL feet/meters	Cloud Cover/Remarks
		START	END		
A - B	8678 - 8682	16:43:13	16:44:41	67000/20420	10 - 30% Cirrus frames 8681 - 8682
B - C	8683 - 8710	16:45:45	16:57:50	67000/20420	Clear
B -D	8711 - 8718	17:16:53	17:19:42	66700/20330	10% Cirrus frame 8714

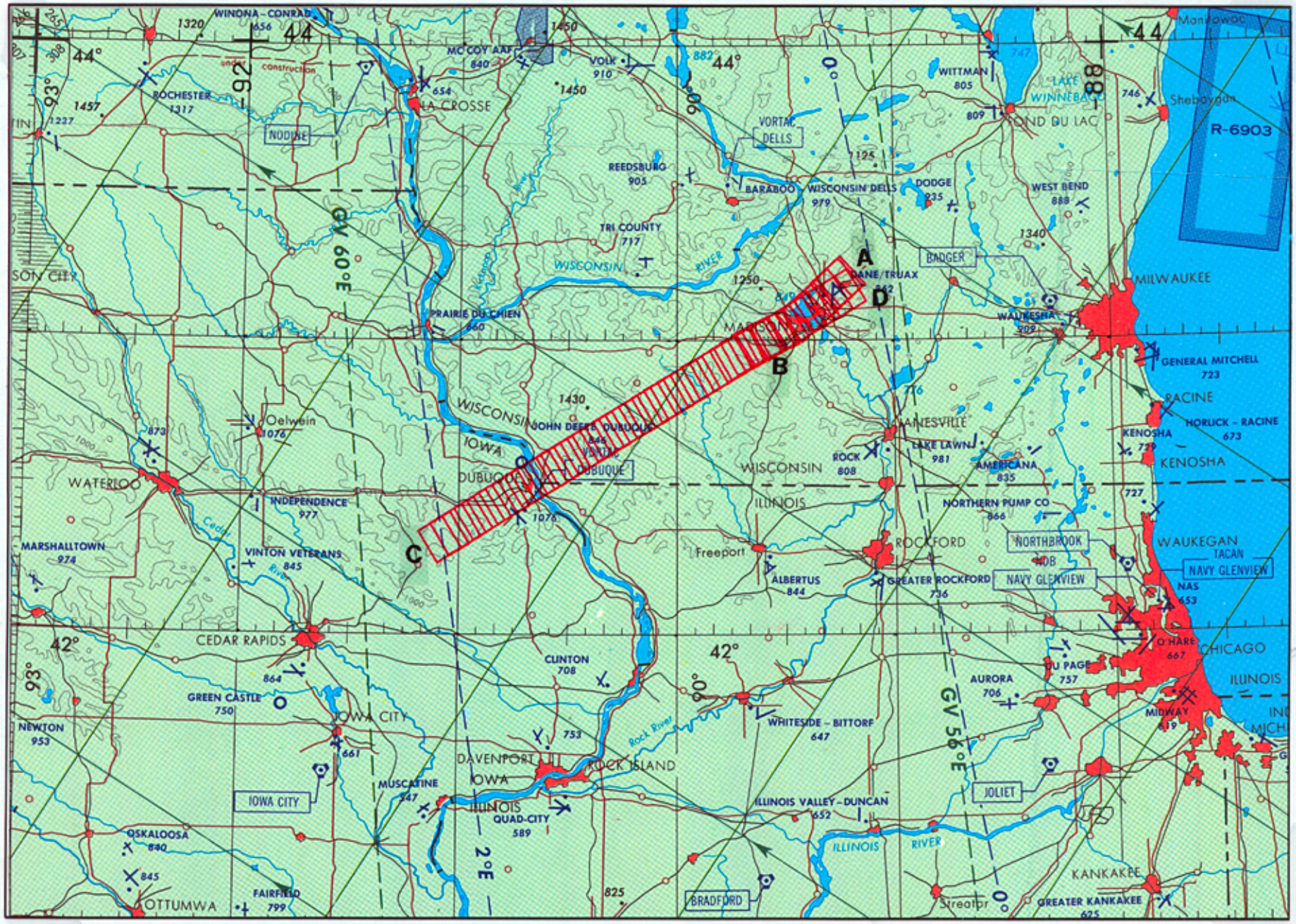
MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 31-MAR-1999 FLIGHT 99-058

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	16:28:38	44.284	-87.980	44.7	147.8	223.62	16:38:43	43.418	-88.955	43.4	149.4	3766
2	16:39:31	43.349	-89.036	43.3	149.5	226.12	16:41:08	43.221	-89.208	43.1	149.7	605
3	16:41:14	43.213	-89.218	43.1	149.8	227.47	16:43:06	43.069	-89.420	42.8	150.1	699
4	16:43:45	43.037	-89.512	42.8	150.2	242.11	16:56:34	42.299	-91.131	41.6	152.0	4796
5	17:02:36	42.240	-91.255	40.8	154.1	58.26	17:18:24	43.184	-89.188	40.0	163.4	5907

NUMBER OF FILES FOR THIS FLIGHT = 5
TOTAL NUMBER OF SCAN LINES = 15773
DATE THESE FILES WERE PROCESSED = 28-Apr-99
DATE THIS LIST WAS CREATED = 29-Apr-99
GRANULE VERSION = 9



FLIGHT 99-058 31 MARCH 1999 A/C 806 MAS50 / NAST-I / NAST-M / SCANNING HIS / VIS / RC-10



FLIGHT 99-058 31 MARCH 1999 A/C 806 RC-10 (12") JNC 44

FLIGHT SUMMARY REPORT

Flight Number: 99-059

Calendar/Julian Date: 1-2 April 1999 • 091-092

Sensor Package: Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I/NAST-M)
High-Resolution Interferometer Sounder (Scanning HIS)

Area(s) Covered: Oklahoma CART Site

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

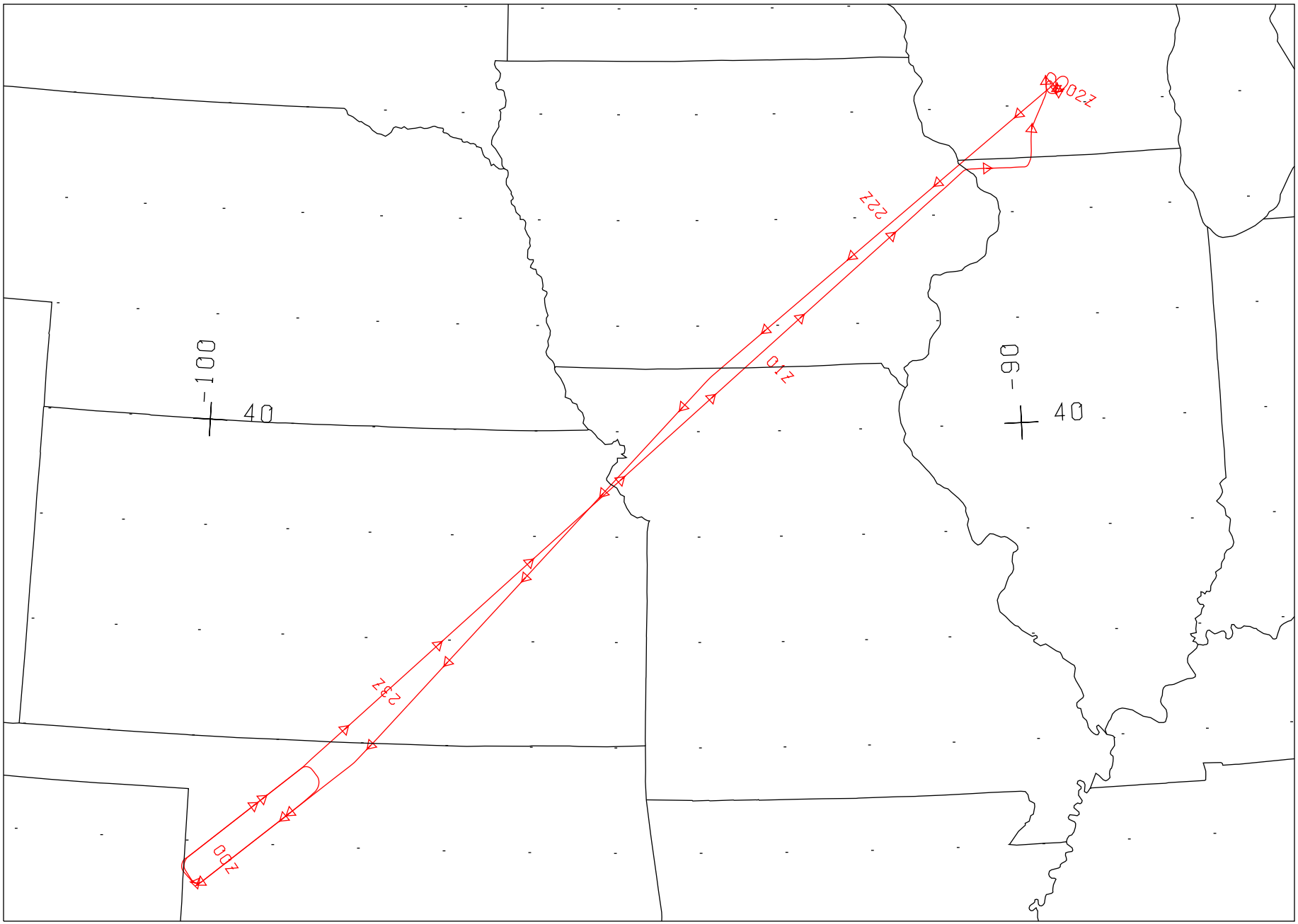
Accession #:	-----	-----	-----	-----	-----
Sensor ID #:	108	118	122	123	083
Sensor Type:	MAS 50	VIS	NAST-I	NAST-M	Scanning HIS
Focal Length:	-----	-----	-----	-----	-----
Film Type:	-----	-----	-----	-----	-----
Filtration:	-----	-----	-----	-----	-----
Spectral Band:	-----	-----	-----	-----	-----
f Stop:	-----	-----	-----	-----	-----
Shutter Speed:	-----	-----	-----	-----	-----
# of Frames:	-----	-----	-----	-----	-----
% Overlap:	-----	-----	-----	-----	-----
Quality:	-----	-----	-----	-----	-----

Remarks:

MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 01-APR-1999 FLIGHT 99-059

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	22:00:45	41.923	-91.569	63.1	250.4	231.45	22:21:05	40.535	-93.809	64.7	253.2	7596
2	22:21:26	40.503	-93.843	64.8	253.3	223.77	22:24:32	40.265	-94.136	65.0	253.8	1159
3	22:24:46	40.250	-94.159	65.1	253.8	223.00	22:39:06	39.070	-95.559	66.4	255.9	5358
4	22:39:08	39.072	-95.562	66.4	255.9	222.68	22:59:43	37.397	-97.440	68.5	258.9	7695
5	23:00:09	37.361	-97.469	68.6	258.9	221.49	23:06:49	36.822	-98.055	69.3	259.9	2494
6	23:07:38	36.761	-98.149	69.4	260.0	231.04	23:24:15	35.609	-99.800	71.2	262.0	6213
7	23:27:34	35.859	-99.943	71.9	262.5	53.68	23:38:42	36.738	-98.689	75.3	264.8	4169
8	23:42:05	36.504	-98.527	75.9	265.2	229.19	23:54:38	35.617	-99.785	77.4	266.6	4694
9	00:10:12	36.765	-98.655	81.8	269.2	45.65	00:14:27	37.101	-98.227	83.0	270.0	1590
10	00:16:11	37.240	-98.049	83.5	270.4	47.89	00:21:06	37.650	-97.517	84.9	271.4	1845
11	00:21:13	37.659	-97.504	84.9	271.4	46.80	00:23:17	37.833	-97.277	85.5	271.9	774
12	00:24:05	37.904	-97.186	85.7	272.1	45.75	00:35:03	38.786	-95.999	88.7	274.4	4103
13	00:38:15	39.037	-95.658	89.6	275.1	49.28	00:55:56	40.414	-93.687	94.3	279.3	6615
14	00:55:57	40.413	-93.688	94.3	279.3	48.87	01:13:35	41.732	-91.673	98.8	283.8	6596

NUMBER OF FILES FOR THIS FLIGHT = 14
TOTAL NUMBER OF SCAN LINES = 60901
DATE THESE FILES WERE PROCESSED = 04-May-99
DATE THIS LIST WAS CREATED = 05-May-99
GRANULE VERSION = 9



FLIGHT 99-059 1-2 APRIL 1999 A/C 806 MAS50 / NAST-I / NAST-M / SCANNING HIS / VIS

FLIGHT SUMMARY REPORT

Flight Number: 99-060

Calendar/Julian Date: 4 April 1999 • 094

Sensor Package: Modis Airborne Simulator (MAS)
Video Imaging System (VIS)
Microwave Temperature Sounder (NAST-I)

Area(s) Covered: Ferry – Madison, Wisconsin to
Dryden Flight Research Center

Investigator(s): Moeller – University of Wisconsin **Aircraft #:** 806

SENSOR DATA

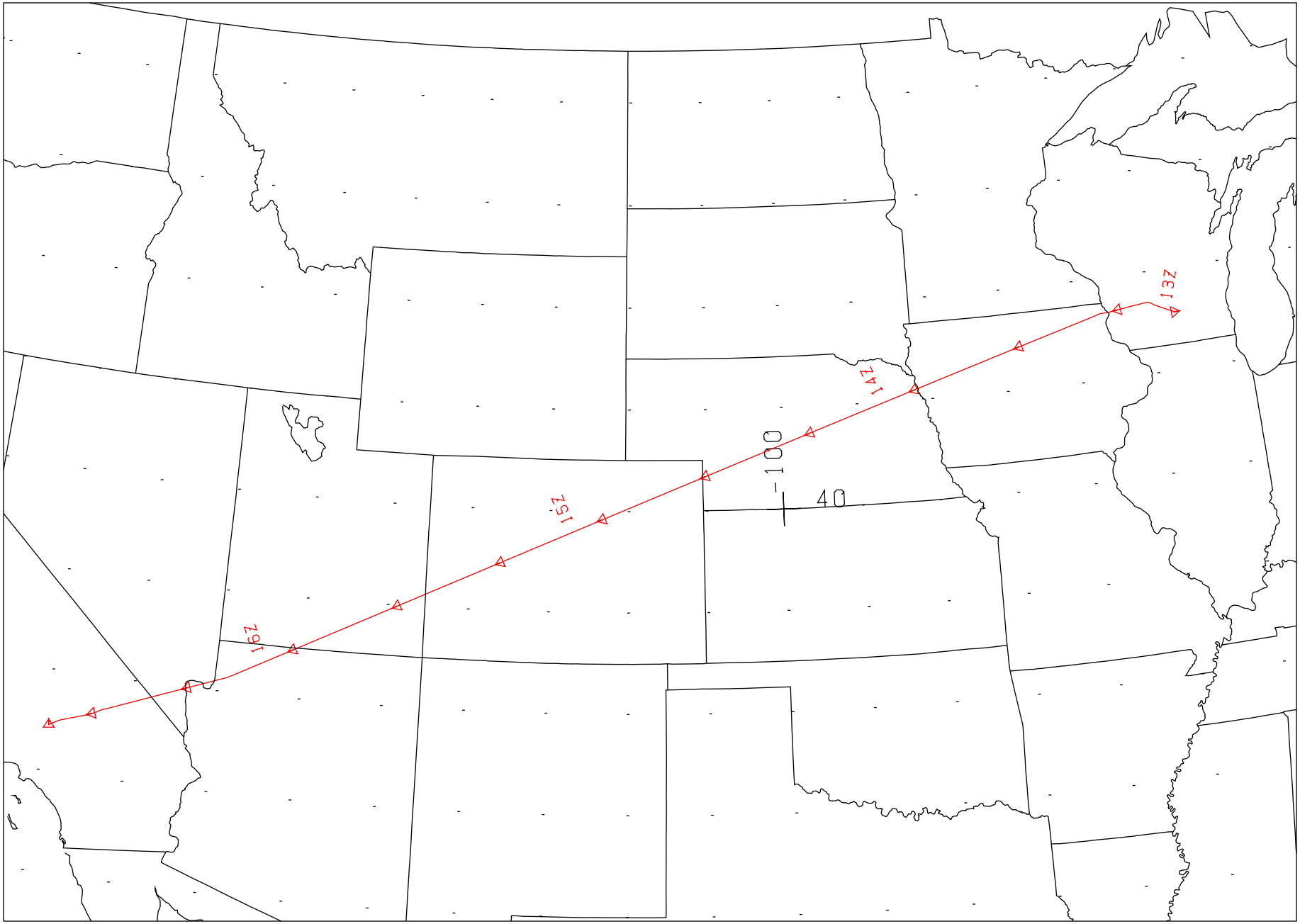
Accession #:	-----	-----	-----
Sensor ID #:	108	118	122
Sensor Type:	MAS 50	VIS	NAST-I
Focal Length:	-----	-----	-----
Film Type:	-----	-----	-----
Filtration:	-----	-----	-----
Spectral Band:	-----	-----	-----
f Stop:	-----	-----	-----
Shutter Speed:	-----	-----	-----
# of Frames:	-----	-----	-----
% Overlap:	-----	-----	-----
Quality:	-----	-----	-----

Remarks:

MODIS AIRBORNE SIMULATOR (MAS) FLIGHT LINE INFORMATION FOR 04-APR-1999 FLIGHT 99-060

	START OF FLIGHT LINE						END OF FLIGHT LINE					
LINE	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	START HEADING	TIME HH:MM:SS	LAT DEG	LON DEG	SOLAR ZEN	SOLAR AZIM	SCAN LINES
1	13:26:19	43.098	-92.348	72.8	98.6	252.68	13:39:42	42.704	-94.227	71.7	99.6	4998
2	13:39:43	42.701	-94.241	71.7	99.6	252.30	13:53:06	42.262	-96.160	70.6	100.4	5001
3	13:53:07	42.259	-96.171	70.6	100.4	250.79	14:06:29	41.787	-98.064	69.5	101.3	4984
4	14:06:30	41.788	-98.062	69.5	101.3	251.38	14:19:51	41.286	-99.924	68.3	102.2	4995
5	14:19:53	41.284	-99.930	68.3	102.2	248.57	14:33:12	40.753	-101.763	67.1	103.0	4977
6	14:33:15	40.752	-101.765	67.0	103.1	248.11	14:46:37	40.196	-103.556	65.8	103.9	4995
7	14:46:38	40.193	-103.565	65.8	103.9	245.38	15:00:00	39.617	-105.305	64.4	104.8	4996
8	15:00:01	39.618	-105.302	64.4	104.8	244.08	15:13:23	39.015	-107.016	63.1	105.8	4995
9	15:13:24	39.014	-107.019	63.1	105.8	244.77	15:26:46	38.378	-108.725	61.7	106.6	4995
10	15:26:47	38.379	-108.724	61.7	106.7	243.54	15:40:07	37.719	-110.397	60.2	107.5	4978
11	15:40:11	37.713	-110.411	60.2	107.5	242.97	15:53:33	37.025	-112.068	58.7	108.4	4975
12	15:53:34	37.025	-112.068	58.7	108.4	239.87	16:06:56	36.318	-113.684	57.2	109.3	4995
13	16:07:48	36.278	-113.786	57.1	109.4	248.18	16:17:59	35.864	-115.107	56.0	110.1	3811

NUMBER OF FILES FOR THIS FLIGHT = 13
TOTAL NUMBER OF SCAN LINES = 63695
DATE THESE FILES WERE PROCESSED = 04-May-99
DATE THIS LIST WAS CREATED = 05-May-99
GRANULE VERSION = 9



FLIGHT 99-060 4 APRIL 1999 A/C 806 MAS50 / NAST-I / VIS